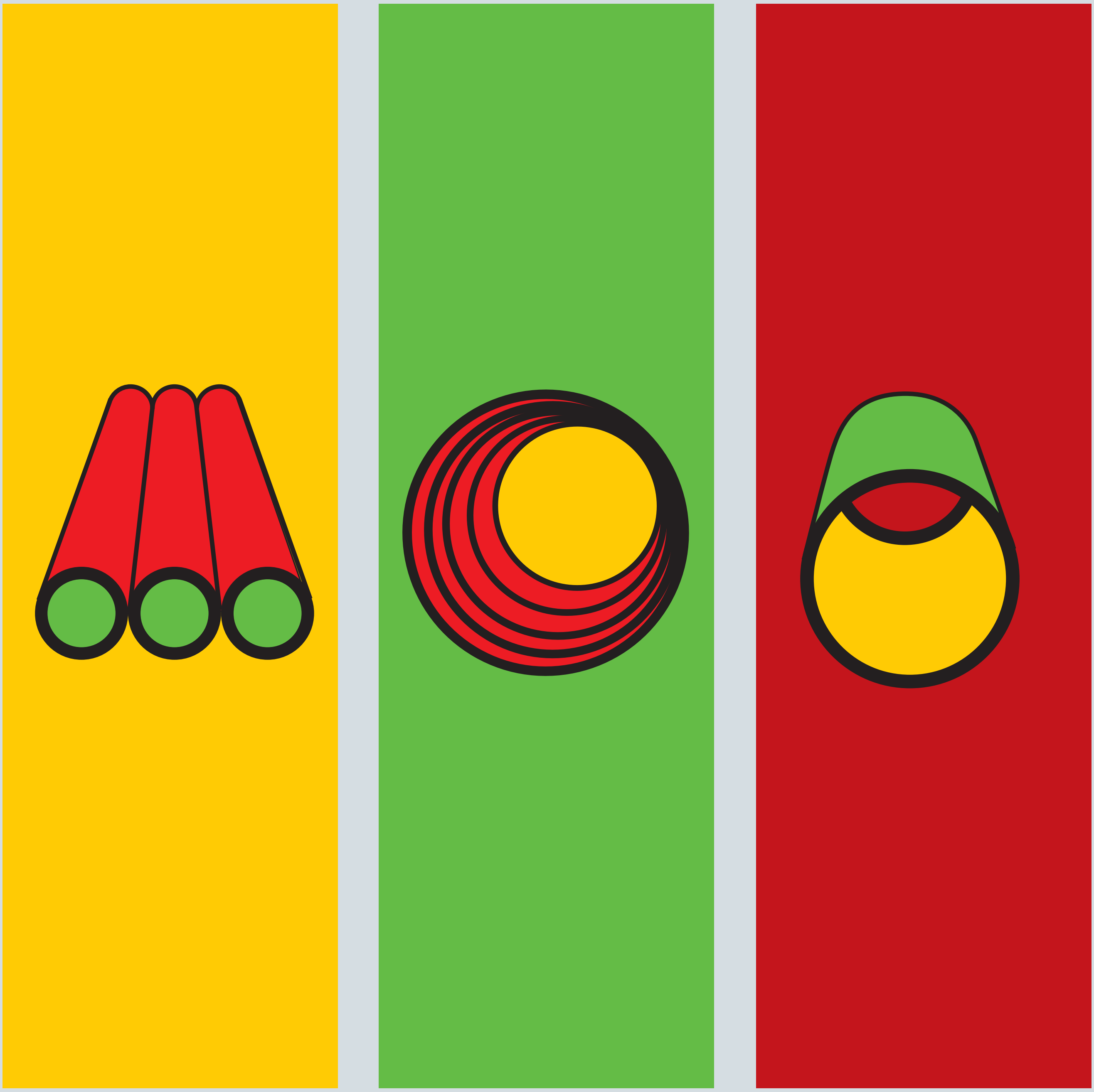
TPS TECHNITUBE®

RÖHRENWERKE GMBH



The unique Databook containing comprehensive information and Comparison Tables on Sizes, weights and general data of Pipes, Tubes, Fittings, Flanges, Bars, Sheet & Strip, Hollow Sections and related products according to main International Standards.

General catalogue

EDITION 2004

Content

TPS-Technitube has been founded 1975 in Ratingen near Düsseldorf. 2 years later the offices and production facilities were established in Daun/ Germany. This was the beginning of the production of tubular goods.

TPS is today a private owned, future orientated company, operating most modern worldwide renowned production mills for oil- and gas field tubular products, for seamless tubes in alloy steel, stainless steels, nickel alloys and titanium grades and non-ferrous metals. For extended surface tubes "Technifin" and "Technistud" as well as for fittings, flanges and other piping and tubing products and accessories.

The production mills of TPS-Technitube Röhrenwerke, located on a total industrial area of more than 600000 sq.ft in Daun, in the center of Europe, have an excellent worldwide reputation as a reliable and competitive manufacturer of high quality piping and tubular goods.

Apart from the production facilities TPS is running stocks for immediate deliveries. The plant facilities as well as the stock facilities allow TPS to serve customers worldwide with standard mill deliverytimes as well as tubes from stock.

TPS supplies mainly to the Oil- & Gas Industry, Refineries, Fertilizer Plants, Chemical Plants, Power Stations, Steel Mills, Heat Exchanger- and Boiler Manufacturers, Sugar Factories, Machinery Plants and to the Automotive Industry.



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Our fully equiped inspection department is in a position to do all the necessary tests and to check and accept your special requirements.

TPS is also specialized in so called "Package Deals" for projects. The customer orders all material for one project from one source. The result is a heavy reduction in costs. From one source just in time simplifies the execution of a project drastically and saves costs considerably.

With this catalogue, TPS is giving complete information about the manufacturing and supply range of alloy steel, stainless steel, nickel alloys, titanium and non-ferrous metals from mill and ex stock.

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Austenitic Stainless Steel Tubes

Material Standard: ASTM A 213 / 249 / 269 / 688

Manufacturing Process Seamless or welded

Grade	UNSNo	C	Si	Mn	P	S
TP 304	S30400	0.08 max	0.75 max	2.00 max	0.040 max	0.030 max
TP 304 H	S30409	0.04-0.10	0.75 max	2.00 max	0.040 max	0.030 max
TP 304 N	S30451	0.08 max	0.75 max	2.00 max	0.040 max	0.030 max
TP 304 LN	S30453	0.035 max	0.75 max	2.00 max	0.040 max	0.030 max
TP 304 L	S30403	0.035 max	0.75 max	2.00 max	0.040 max	0.030 max
TP 309 S	S30908	0.08 max	0.75 max	2.00 max	0.045 max	0.030 max
TP 310 S	S31008	0.08 max	0.75 max	2.00 max	0.045 max	0.030 max
TP 316	S31600	0.08 max	0.75 max	2.00 max	0.040 max	0.030 max
TP 316 H	S31609	0.04-0.10	0.75 max	2.00 max	0.040 max	0.030 max
TP 316 L	S31603	0.035 max	0.75 max	2.00 max	0.040 max	0.030 max
TP 316 N	S31651	0.08 max	0.75 max	2.00 max	0.040 max	0.030 max
TP 316 LN	S31653	0.035 max	0.75 max	2.00 max	0.040 max	0.030 max
TP 317	S31700	0.08 max	0.75 max	2.00 max	0.040 max	0.030 max
TP 317 L	S31703	0.035 max	0.75 max	2.00 max	0.040 max	0.030 max
TP 321	S32100	0.08 max	0.75 max	2.00 max	0.040 max	0.030 max
TP 321 H	S32109	0.04-0.10	0.75 max	2.00 max	0.040 max	0.030 max
TP 347	S34700	0.08 max	0.75 max	2.00 max	0.040 max	0.030 max
TP 347 H	S34709	0.04-0.10	0.75 max	2.00 max	0.040 max	0.030 max

Ferritic and Martensitic Stainless Steel Tubes

Material Standard ASTM-A 268

Manufacturing Process seamless or welded

Grade	UNSNo	C	Si	Mn	P	S
TP 405	S40500	0.08 max	0.75 max	1.00 max	0.040 max	0.030 max
TP 410	S41000	0.15 max	0.75 max	1.00 max	0.040 max	0.030 max
TP 429	S42900	0.12 max	0.75 max	1.00 max	0.040 max	0.030 max
TP 430	S43000	0.12 max	0.75 max	1.00 max	0.040 max	0.030 max
TP 446-1	S44600	0.20 max	0.75 max	1.50 max	0.040 max	0.030 max
TP 446-2	S44600	0.12 max	0.75 max	1.50 max	0.040 max	0.030 max
TP 409	S40900	0.08 max	1.00 max	1.00 max	0.045 max	0.045 max
TP 430 TI	S43036	0.10 max	1.00 max	1.00 max	0.040 max	0.030 max

Ferritic and Martensitic Stainless Steel Tubes

Material Standard ASTM A 789

Manufacturing Process Seamless or welded

UNSNo	C	Si	Mn	P	S	Ni	Cr	Mo
S31803	0.03 max	1.00 max	2.00 max	0.030 max	0.020 max	4.50-6.50	21.0-23.0	2.50-3.50
S31500	0.03 max	1.40-2.00	1.20-2.00	0.030 max	0.030 max	4.25-5.25	18.0-19.0	2.50-3.00
S32550	0,04 max	1.00 max	1.50 max	0.040 max	0.030 max	4.50-6.50	24.0-27.0	2.90-3.90
S31200	0.030 max	1.00 max	2.00 max	0.045 max	0.030 max	5.50-6.50	24.0-26.0	1.20-2.00
S31260	0.030 max	0.75 max	1.00 max	0.030 max	0.030 max	5.50-7.50	24.0-26.0	2.50-3.50
S32304	0.030 max	1.00 max	2.50 max	0.040 max	0.040 max	3.0-5.5	21.5-24.5	0.05-0.60
OD 1 in [25mm] and Under								
OD over 1 in. [25 mm]								
S32750	0.030 max	0.80 max	1.20 max	0.035 max	0.020 max	6.0-8.0	24.0-26.0	3.0-5.0
S32760	0.05 max	1.00 max	1.00 max	0.030 max	0.010 max	6.00-8.00	24.0-26.0	3.00-4.00

Ni	Cr	Mo	Others	YS min KSI [MPa]	TS min KSI [MPa]	El.* min
8.00-11.00	18.00-20.00	...		30[205]	75[515]	35
8.00-11.00	18.00-20.00	...		30[205]	75[515]	35
8.00-11.00	18.00-20.00	...	N 0.10 - 0.16	35[240]	80[550]	35
8.00-11.00	18.00-20.00	...	N 0.10 - 0.16	30[205]	75[515]	35
8.00-13.00	18.00-20.00	...		25[170]	70[485]	35
12.00 -15.00	22.00-24.00	...		30[205]	75[515]	35
19.00-22.00	24.00-26.00	0.75 max		30[205]	75[515]	35
11.00-14.00	16.00-18.00	2.00-3.00		30[205]	75[515]	35
11.00-14.00	16.00-18.00	2.00-3.00		30[205]	75[515]	35
10.00-15.00	16.00-18.00	2.00-3.00		25[170]	70[485]	35
11.00-14.00	16.00-18.00	2.00-3.00	N 0.10 - 0.16	35[240]	80[550]	35
11.00-14.00	16.00-18.00	2.00-3.00	N 0.10 - 0.16	30[205]	75[515]	35
11.00-14.00	18.00-20.00	3.00-4.00		30[205]	75[515]	35
11.00-15.00	18.00-20.00	3.00-4.00		30[205]	75[515]	35
9.00-13.00	17.00-20.00	...	Ti ≥ 5xC, max 0.60%	30[205]	75[515]	35
9.00-13.00	17.00-20.00	...	Ti ≥ 4xC, max 0.60%	30[205]	75[515]	35
9.00-13.00	17.00-20.00	...	Co + Ta ≥ 10xC, max 1.00%	30[205]	75[515]	35
9.00-13.00	17.00-20.00	...	Co + Ta ≥ 8xC, max 1.00%	30[205]	75[515]	35

Ni	Cr	Mo	Others	YS min KSI [MPa]	TS min KSI [MPa]	El.* min
0.50 max	11.50-13.50	...	Al 0.10 - 0.30	30[205]	60[415]	20
0.50 max	11.50-13.50	...		30[215]	60[415]	20
0.50 max	14.00-16.00	...		35[240]	60[415]	20
0.50 max	16.00-18.00	...		35[240]	60[415]	20
0.50 max	23.00-30.00	...	N 0.10 - 0.25	40[275]	70[485]	18
0.50 max	23.00-30.00	...	N 0.10 - 0.25	40[275]	65[450]	20
0.50 max	10.50-11.75	...	Ti 6xC min; 0.75 max	30[205]	55[380]	20
0.75 max	16.00-19.50	...	Ti 5xC min; 0.75 max	35[240]	60[415]	20

*Elongation in 2 in or 50 mm, (or 4D), min, %

N	Cu	Others	YS KSI [Mpa]	TS KSI [Mpa]	El*	Brinell	Rock-well C
0.08-0.20	...	...	65[450]	90[620]	25	290	30.5
0.05-0.10	...	...	64[440]	92[630]	30	290	30.5
0.10-0.25	1.50-2.50	...	80[550]	110[760]	15	297	31.5
0.14-0.20	...	...	65[450]	100[690]	25	280	...
0.10-0.30	0.20-0.80	W 0.10-0.50	65[450]	100[690]	25	290	30.5
0.05-0.20	0.05-0.60	...					
			65[450]	100[690]	25	...	...
			58[400]	87[600]	25	290	30.5
0.24-0.32	0.50 max	...	80[550]	116[800]	15	310	32
0.20-0.30	0.50-1.00	W 0.50-1.00	80[550]	109-130 [750-895]	25	270	...

*Elongation in 2 in or 50 mm, (or 4D), min, %

COMPARISON OF INTERNATIONAL STANDARDS FOR STAINLESS STEEL

Werkstoff-Nr.	DIN.	AISI.	UNS.	AFNOR.	BS.	JIS	SS.	GOST
1.4000	X6Cr13	403(410S)	S 41008	Z6C13	403 S17	SUS 403	2301	08Ch13
	(X7Cr13)							
1.4002	X6CrAl13	405	S40500	Z6CAl13	405 S17	SUS 405		08Ch11NYU
	(X7CrAl13)							
1.4006	X10Cr13	410	S 41000	Z12C13	410 S21	SUS 410	2302	12Ch13
1.4016	X6Cr17	430	S43000	Z8C17	430 S15	SUS 430	2320	12Ch17
	(X8Cr17]				430 S17			
1.4021	X20Cr13	420	S42000	Z20C13	420 S29	SUS 420J1	2303	20Ch13
					420 S37	SUS 420J2		
					420 S45			
1.4024	X15Cr13	410	S 41000	...	420 S29	SUS 410J1	...	...
					410 S21			
1.4028	X30Cr13	420	S 42000	Z30C13	420 S45	SUS 420J2	2304	30Ch13
1.4031	X38Cr13	420	S 42000	Z40C14	...	SUS 420J2	2304	40Ch13
	(X40Cr13)							
1.4034	X46Cr13	420	S42000	Z40C14	420 S45	...	...	40Ch13
				Z38C13M				
1.4057	X20CrNi172	431	S43100	Z15CN 16-02	431 S29	SUS 431	2321	20Ch17N2
	(X22CrNi17)							
1.4510	X6CrTi17	XM8	...	Z8CT17	...	SUS 430LX	...	08Ch17T
	(X8CrTi17)	430Ti						
1.4512	X6CrTi12	409	S 40900	Z6CT12	409 S19	SUH 409	...	...
					409 S17			
1.4301	X5CrNi1810	304/304H	S 30400	Z6CN18-09	304 S31	SUS 304	2332	08Ch18N10
	(X5CrNi189)							
1.4305	X10CrNiS189	303	S 30300	Z10CNF 18-09	303 S21	SUS 303	2346	...
	(X12CrNiS188)							
1.4306	X2CrNi1911	304L	S 30403	Z2CN18-10	304 S12	SCS 19	2352	03Ch18N11
	(X2CrNi 189)			Z3CN19-10M	304 C12	SUS 304L	2333	
	(G-X2Cr189)			Z2CN 18-09	304 S11			
1.4310	X12CrNi177	301	S 30100	Z12CN17-07	301 S21	SUS 301	...	...
				Z12Cn18-07				
1.4311	X2CrNiN 1810	304LN	S 30453	Z2CN18-10Az	304 S62	SUS 304LN	2371	...
1.4401	X5CrNiMo17122	316	S	31600 Z6CND17-11	316 S16	SUS 316	2347	...

Werkstoff-Nr.	DIN.	AISI.	UNS.	AFNOR.	BS.	JIS	SS.	GOST
1.4404	X2CrNiMo17132	316L	S 31603	Z2CND 18-13	316 S14	SUS 316L	2348	...
	(X2CrNiMo1810)			Z2CND 17-12				
	(G-X2CrNiMo1810)							
1.4429	X2CrNiMoN17133	316LN	S31653	Z2CND 17-13	...	SUS 316LN	2375	...
	(X2CrNiMoN1813)							
1.4435	X2CrNiMo18143	316L	S 31603	Z2CND 17-13	316 S11	SCS 16	2353	03Ch17N14M2
	(X2CrNiMo1812)				316 S12	SUS 316L		
					316 S13			
1.4436	X5CrNiMo17133	316	S 31600	Z6CND 17-12	316 S16	SUS 316	2343	...
	(X5CrNiMo1812)				316 S33			
1.4438	X2CrNiMo18164	317L	S31703	Z2CND 19-15	317 S12	SUS 317L	2367	...
	(X2CrNiMo1816)							
1.4439	X2CrNiMoN17135	317LNM	S 31726	Z2CND 19-15	317 S16	...	...	...
1.4449	X5CrNiMo 1713	317	...	...	317 S16	SUS 317	...	...
1.4465	X1CrNiMoN25252	...	N 08310	...	...	...	...	...
1.4505	X5CrNiMoCuNb2018	...	...	...	...	...	...	07Ch17N20M2D2T
1.4521	X2CrMoTi182	440	S44400	...	...	...	2326	...
1.4529	X1NiCrMoCuN25206	...	N 08925	...	...	...	...	...
1.4539	X1NiCrMoCu25205	904L	N 08904	Z1NCDU25-2004	...	...	2562	...
1.4541	X6CrNiTi1810	321	S 32100	Z6CNT18-10	321 S12	SUS 321	2337	1Ch18N12T
	(X10CrNiTi189)				321 S20			
					(321 S31)			
1.4550	X6CrNiNb1810	347	S 34700	Z6CNNb 18-10	347 S17	SUS 347	2338	08Ch 18N12B
	(X10CrNiNb189)				347 S31			
1.4558	X2NiCrAlTi3220	...	N 08800	...	...	...	...	...
1.4563	X1NiCrMoCuN31274	...	N 08028	Z1NCDU31273Az	...	...	...	...
1.4571	X6CrNiMoTi17122	316Ti	S 31635	Z6CNDT 17-12	320 S31	...	2350	10Ch17N13M2T
	(X10CrNiMo Ti1810)				320 S17			
1.4580	X6CrNiMoNb17122	316 Cb	...	Z6CNDNb17-12	...	...	...	08Ch16N13M2B
	(X10CrNiMoNb 1810)			Z6CNDNb19-13				
1.4583	X10CrNiMoNb1812	318	...	...	...	...	...	...
1.4586	X5CrMoCuNb2218	...	...	...	...	...	...	...

Werkstoff-Nr.	DIN.	AISI.	UNS.	AFNOR.	BS.	JIS	SS.	GOST
1.4335	X1CrNi2521	310LC	...	Z2CN25-20	...	...	...	...
1.4713	X10CrAl7	...	...	Z8CA7	...	...	...	...
1.4718	X45CrSi93	HNV3	...	Z45CS9	401 S45	SUH 1	...	...
1.4724	X10CrAl13	(405)	...	Z10C13	403 S17	...	...	...
1.4742	X10CrAl18	(430)	...	Z10CAS18	430 S15	SUS 430	...	...
						SUH 21		
1.4749	X18CrN28	446-1	...	..	...	...	...	Ch25
1.4762	X10CrAl24	(446)	...	Z10CAS24	...	...	...	...
1.4821	X20CrNiSi254	327	...	Z20CNS25-04	...	...	...	...
1.4828	X15CrNiSi2012	309	...	Z15CNS20_12	309 S24	SUH 309	...	Ch24N12S1
1.4833	X7CrNi2314	309S	...	Z15CN24-13	...	SUS 309S	...	...
1.4841	X15CrNiSi2520	314/310	...	Z12CNS25-20	...	SUH 310	...	20Ch25N20S2
1.4845	X12CrNi2521	310S	...	Z12CN25-20	310 S24	SUH 310	2361	10Ch23N18
						SUS 310S		
1.4848	(G-X40CrNiSi2520)	...	...	...	310 C40	SCH 21	...	...
1.4864	X12NiCrSi3616	330	N 08330	Z12NCS37-18	Na 17	SUH 330	...	...
				Z12NCS35-16				
				Z12NC37-18				
1.4871	X53CrMnNiN219	EV8	...	Z52CMN21-09	349 S54	SUH 35	...	...
						SUH 36		
1.4876	X10NiCrAlTi3320	B163	N 08800	Z8NC32-21	NA 15(H)	NCF 8000	...	...
1.4876	X10CrNiAlti3320	B163	N 08810	Z8NC32-21	NA 15	...	...	...
1.4878	X12CrNiTi189	321H	...	Z6CNT18-12(B)	321 S20	SUS 321	2337	...
					(321 S12)			
1.4893	...	...	S 30815	...	...	...	2368	...
...	...	...	S 32750	...	...	...	...	...
1.4362	...	...	S 32304	...	...	...	...	...
1.4417	...	...	S 31500	...	...	...	...	...
1.4460	X4CrNiMo2751	329	S 32900	...	...	SUS 329J1	2324	...
	(X8CrNiMo275)					SCH 11		
						SCS 11		
1.4462	X2CrNiMoN2253	...	S 31803	Z2CND22-05Az	...	...	...	...
...	...	...	S 31200	...	...	...	...	...
...	...	...	S 31260	...	...	...	...	...
...	...	...	S 32550	...	...	...	...	...
...	...	...	S 32950	...	...	...	...	...

(...) hitherto existing DIN-designation

Chemical composition and mechanical properties

Material Standard SEW 470

DIN	Material grade	%C	%Si	%Mn max	%P max	%S max	%Al	%Cr	%Ni	% Others
Ferritic steels										
X 10 CrAl 7	1.4713	≤ 0.12	0.5 to 1.0	1.0	0.040	0.030	0.5 to 1.0	6.0 to 8.0	...	...
X 7 CrTi 12	1.4720	≤ 0.08	≤ 1.0	1.0	0.040	0.030	...	10.5 to 12.5	...	Ti ≥ 6 x %C ≤ 1.0
X 10 CrAl 18	1.4742	≤ 0.12	0.7 to 1.4	1.0	0.040	0.030	0.7 to 1.2	17.0 to 19.0	...	...
X 10 CrAl 24	1.4762	≤ 0.12	0.7 to 1.4	1.0	0.040	0.030	1.2 to 1.7	23.0 to 26.0	...	...
Ferritic-austenitic steels										
X 20 CrNiSi 25 4	1.4821	0.10 to 0.20	0.8 to 1.5	2.0	0.040	0.030	...	24.0 to 27.0	3.5 to 5.5	...
Austenitic steel										
X 12 CrNiTi 18 9	1.4878	≤ 0.12	≤ 1.0	2.0	0.045	0.030	...	17.0 to 19.0	9.0 to 12.0	Ti ≥ 4 x %C ≤ 0.8
X 15 CrNiSi 20 12	1.4828	≤ 0.20	1.5 to 2.5	2.0	0.045	0.030	...	19.0 to 21.0	11.0 to 13.0	...
X 12 CrNi 25 21	1.4845	≤ 0.15	≤ 0.75	2.0	0.045	0.030	...	24.0 to 26.0	19.0 to 22.0	...
X 15 CrNiSi 25 20	1.4841	≤ 0.20	1.5 to 2.5	2.0	0.045	0.030	...	24.0 to 26.0	19.0 to 22.0	...
X 12 NiCrSi 36 16	1.4864	≤ 0.15	1.0 to 2.0	2.0	0.030	0.020	...	15.0 to 17.0	33.0 to 37.0	...
X 10 NiCrAlTi 32 20	1.4876	≤ 0.12	≤ 1.0	2.0	0.030	0.020	0.15 to 0.6	19.0 to 23.0	30.0 to 34.0	Ti 0.15 to 0.6

Mechanical Properties at Room Temperature

DIN	Material grade	Heat treatment condition	Hardness HB max	Yield Strength 0.2 limit N/mm² min	Tensile Strength N/mm²	Elongation (LO = 5dO) longit. % min	transv. % min
Ferritic steels							
X 10 CrAl 7	1.4713	annealed	192	220	420 to 620	20	15
X 7 CrTi 12	1.4720	annealed	179	210	400 to 600	25	20
X 10 Cr Al 18	1.4742	annealed	212	270	500 to 700	12	9
X 10 CrAl 24	1.4762	annealed	223	280	520 to 720	10	7
Ferritic-austenitic steels							
X 20 CrNiSi 25 4	1.4821	quenched	235	400	600 to 850	16	12
Austenitic steels							
X12 CrNiTi 18 9	1.4878	quenched	192	210	500 to 750	40	30
X15 CrNiSi 20 12	1.4828	quenched	223	230	500 to 750	30	22
X 12 CrNi 25 21	1.4845	quenched	192	210	500 to 750	35	26
X 15 CrNiSi 25 20	1.4841	quenched	223	230	550 to 800	30	22
X12 NiCrSi 36 16	1.4864	quenched	223	230	550 to 800	30	22
X 10 NiCrAiTi 32 20	1.4876	recrystallised annealed	192	210	500 to 750	30	22
		solution annealed	192	170	450 to 700	30	22

Abovementioned values are applicable only for samples ≥ 3 mm.

Techalloy 200 is technically pure nickel with good mechanical properties and excellent resistance to alkali hydroxides, dry halogen hydrides as well as organic compositions. Even when exposed to high temperatures, Techalloy 200 retains its strength and is ductile at low temperatures. Techalloy 200 is a multipurpose grade and is used in applications where alloys are not essential. It also has good magnetic and magnet ostrictive properties, high thermal and electrical conductivity as well as low gas content in the elctronics industry. Furthermore Techalloy 200 is of interest for its good weldability.

Chemical Composition in %

C	Si	Mn	Fe	Ni	S	Cu
0,15 max.	0,35 max.	0,35 max.	0,4 max.	99,0 min.	0,010 max.	0,25 max.

Mechanical Properties - at room temperature - annealed condition

0,2 % yield strength	tensile strength	elongation (A5)
N/mm3	N/mm 3	%
105 min.	380 min.	35 min.

Specification

Seamless Pipes/Tubes: ASTM-B-161

Welded Pipes/Tubes: ASTM-B-725/730

Plates/Sheets: ASTM-B-162

Bars: ASTM-B-160

Fittings: ASTM-B-366

Flange: ASTM-B-564

Specific weight: 8,89 kg/dm3

Melting range: 1435 - 1445° C

Welding methods: Arc welding, TIG, MIG, autogenous welding without thermal retreatment (details on request)

Machineability: Table on request

Corrosion Resistance: Refer to table Corrosion Data

Product forms: Tubes and pipes, fittings,, flanges, plates and sheets, bars, forgings (cast iron), profiles, wire

Range of application: chemical and food industry, loading plants, electrical and electronical parts, parts and equipment for aircrafts and rokkets, transducers etc.



Techalloy 201 is an alloy similar to Nickel 200. The carbon content of the former is a little above that of Nickel 200. Due to this difference, Techalloy 201 is preferred in caustic soda above 300° C. Techalloy 201 disposes of the same high thermal and electrical conductivity and of the same magnetic and megnetostrictive properties as the grade Nickel 200.

Chemical Composition in %

C	Si	Mn	Fe	Ni	S	Cu
0,020 max.	0,35 max.	0,35 max.	0,40 max.	99,0 min.	0,01 max.	0,25 max.

Mechanical Properties - at room temperature - annealed condition

0,2 % yield strength	tensile strength	elongation (A5)
N/mm3	N/mm3	%
80	380	35

Specification:

Seamless Pipes/Tubes: ASTM-B-161

Welded Pipes/Tubes: ASTM-B-725/730

Plates/Sheets: ASTM-B-162

Bars: ASTM-B-160

Fittings: ASTM-B-366

Flange: ASTM-B-564

Specific weight: 8,89 kg/dm3

Melting range: 1435 - 1445° C

Welding methods: Arc welding, TIG, MIG, autogenous welding without thermal retreatment (details on request.)

Machineability: Table on request

Corrosion resistance: Refer to table Corrosion Data

Product forms: Tubes and pipes, fittings, flanges, plates and sheets, bars, forgings (cast iron), profiles, wire

Range of application: Caustic evaporators, plating rods, combustion boats, chemical plants with operating temperatures above 300° C, for example in caustic soda manufacturing plants.



Techalloy 400

UNS NO. N04400, DIN W.NR. 2.4360

TECHALLOY 400 is a weldable nickel-copper alloy with good resistance to sea water, alkaline acids, organic acids, pharmaceutical products, ammonium sulfate, fatty acid etc. Tensile strength and ductility are retained in operating temperatures of max. 450° C.

Chemical Composition in %

C	Si	Mn	Fe	Ni	S	Cu
0,30 max.	0,5 max.	2,0 max.	2,5 max.	63,0 max.	0,024 max.	28,0 - 34,0

Mechanical Properties - at room temperature - annealed condition

0,2 % yield strength	tensile strength	elongation (A5)
N/mm2	N/mm2	%
195 min.	480 min.	35 min.

Specification:

Seamless Pipes/Tubes: ASTM-B-165

Welded Pipes/Tubes: ASTM-B-725/730

Plates: ASTM-B-127

Bars: ASTM-B-164

Fittings: ASTM-B-366

Flange: ASTM-B-564

Specific weight: 8,83 kg/dm3

Melting range: 1300 - 1350° C

Welding methods: Arc welding, TIG, MIG, UP, autogenous welding, without thermal retreatment (details on request)

Machineability: Table on request

Corrosion: Refer to table ”Corrosion Data”

Product forms: Tubes and pipes, fittings, flanges, plates and sheets, bars, forgings (cast iron), profiles, wire

Range of application: Techalloy 400 is mainly employed for valves and pumps, pump and propeller shafts, metal fittings and machine parts for ships, electronic and electric parts, tanks for petrol and drinking water, distilling apparatus for crude petroleum, electric water heater, plants for the chemical industry



TECHALLOY K 500 is an age-hardening alloy which combines the high corrosion resistance of Techalloy 400 with increased tensile strength and hardness. With low permeability, Techalloy K 500 is not magnetic up to - 135° C.

Chemical Composition in %

C	Si	Mn	Fe	Ni	S	Cu	Al	Ti
0,25 max.	0,5	1,5 max.	2,0 max.	63,0 min.	0,010 max.	27,0-33,0	2,3-3,2	0,35-0,85

Mechanical Properties - cold worked - cold drawn condition

0,2% yield strength	tensile strength	elongation (A5)
N/mm	N/mm2	%
620	900	15
min.	min.	min.

Specification:

Pipes/Tubes:	BS 3074 NA 18
Bars:	BS 3074 Na 18
Specific weight:	8,46 kg/dm 3
Melting rage:	1315 - 1350° C
Welding methods:	Arc welding, TIG, MIG, autogenous welding, thermal retreatment required (details on request)
Machineability:	Table on request
Corrosion resistance:	Refer to table "Corrosion Data"
Product forms:	bars and forgings
Range of application:	Techalloy K 500 is mainly used for propeller shafts, Cardan and pump shafts, petrol drilling, bolts, doctor blades, scraping knifes, valve spindles, electronical parts, medical instruments and springs.



Techalloy 600

UNS NO. N06600, DIN W.NR. 2.4816

Techalloy 600 has excellent mechanical properties and oxidation resistance at high temperatures. It is a standard engineering material and mainly employed in applications, which require the combination of resistance to corrosion and heat.

Chemical Composition in %

C	Si	Mn	Fe	Cr	Ni	S	Cu
0,15 max.	0,5 max.	1,0 max.	6,0-10,0	14,0-17,0	72,0 min.	0,015 max.	0,5 max.

Mechanical Properties - at room temperature - annealed, cold drawn condition

0,2 % yield strength	tensile strength	elongation (A5)
N/mm2 240 min.	N/mm2 550 min.	% 30 min.

Specification:

Seamless Pipes/Tubes: ASTM-B-167

Welded Pipes/Tubes: ASTM-B-516/517

Plates/Sheets: ASTM-B-168

Bars: ASTM-B-166

Fittings: ASTM-B-366

Flange: ASTM-B-564

Specific weight: 8,42 kg/dm 3

Melting rage: 1355 - 1415° C

Welding methods: Arc welding, TIG, MIG, UP and autogenous welding (details on request)

Machineability: Table on request

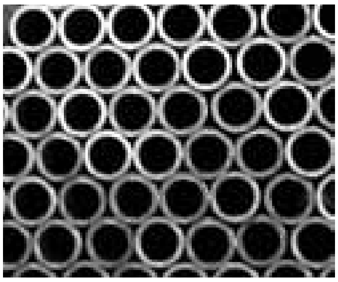
Corrosion resistance: Refer to table "Corrosion Data"

Product forms: Tubes and pipes, fittings, flanges, plates and sheets, bars, forgings (cast iron), wire

Range of application: Techalloy 600 is employed for muffles, heat exchanger tubes, evaporator tubes, combustion-chamber liners, nuclear reactors, plants for the food and chemical industry etc.







Techalloy 601

UNS NO. N06601, DIN W.NR. 2.4851

Techalloy 601 has very good properties at high temperatures and is oxidation resistant as well as scale-resistant at temperatures of up to 1250°C. The high chromium content results in good resistance oxidation, carburization and sulfurous media. The aluminium and nickel content result in a further improvement of the oxidation resistance.

Chemical Composition in %

C	Si	Mn	Fe	Cr	Ni	S	Cu	AL
0,10 max.	0,50 max.	1,0 max.	Rest	21,0- 25,0	58,0- 63,0	0,015 max.	1,0 max.	1,0- 1,7

Mechanical Properties - at room temperature - solution annealed, cold drawn

0,2 % yield strength	tensile strength	elongation (A5)	hardness
N/mm 2 205-415	N/mm 2 550-760	% 65-35	RB 70-95

Specification:

Seamless Pipes/Tubes: ASTM-B-167

Plates/Sheets: ASTM-B-168

Bars: ASTM-B-166

Fittings: ASTM-B-366

Flange: ASTM-B-564

Specific weight: 8,06 kg/dm 3

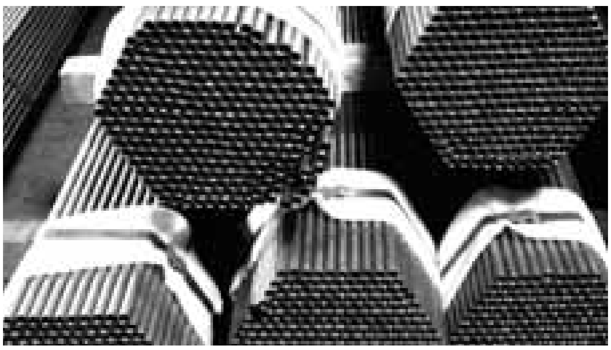
Melting range: 1300 - 1370° C

Welding methods: Details on request

Machineability: Table on request

Product forms: Tubes and pipes, plates and sheets, bars wire, fittings and flanges

Range of application: heat treating baskets and fixtures, trays, radiant tubes, muffles, retorts, flame shields, burner nozzls etc. Techalloy 601 is a new grade for the space and processing industry.





Techalloy 625

UNS NO. N06625, DIN W.NR. 2.4856

Techalloy 625 is an alloy with high resistance and ductility at lowest temperatures and up to 1100° C. Techalloy 625 is not magnetic and apart from its high oxidation resistance it is also resistant against many media. High resistance against stress corrosion cracking, pitting and crevice corrosion is also a main characteristic of Techalloy 625.

Chemical Composition in %

C	Si	Mn	Fe	Cr	Ni	S	Mo	Al	Nb/Ta	Ti	P	Co
0,10 max.	0,5 max.	0,50 max.	5,0 max.	20,0-23,0	58,0 min.	0,015 max.	8,0-10,0	0,40 max.	3,15-4,15	0,40 max.	max. 0,015	max. 1,0*

** If determined*

Mechanical Properties - at room temperature - solution annealed condition

0,2 % yield strength	tensile strength	elongation (A5)
N/mm2	N/mm2	%
414 min.	827 min.	30 min.

Specification:

Seamless Pipes/Tubes:	ASTM-B-444
Welded Pipes/ Tubes:	ASTM-B-704/705
Plates/ Sheets:	ASTM-B-443
Bars:	ASTM-B-446
Fittings:	ASTM-B-366
Flange:	ASTM-B-564
Specific weight:	8,44 kg/dm 3
Melting range:	1290 - 1350° C
Welding methods:	Arc welding, TIG,MIG, UP and autogenous welding (details on request)
Machineability:	Table on request
Product forms:	Tubes and pipes, plates and sheets, bars, wire, fittings and flanges
Range of application:	fuel and hydraulic line tubing, thrust-reverser systems, spray bars, bellows, thrust-chamber tubing for rocket motors, reaction vessels, distillation columns, heat exchanger tubes, valves etc.





Techalloy 800

UNS NO. N08800, DIN W.NR. 1.4876

Techalloy 800 is an austenitic alloy with high tensile strength and resistance against oxidation and carburization at high temperatures. This grade is resistant to stress corrosion cracking, sulfurous media and scale. The solution annealed execution of Techalloy 800, Techalloy 801, has significantly highercreep strength.

Chemical Composition in %

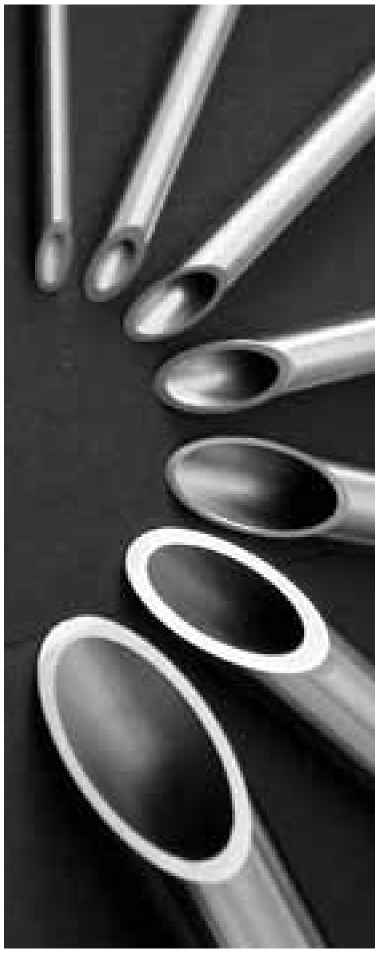
Ni	C	Mn	Fe	S	Si	Cu	Cr	Al	Ti
30,0 35,0	0,10 max.	1,5 max.	Rest (Balance)	0,015 max.	1,0 max.	0,75 max.	19,0- 23,0	0,15- 0,60	0,15- 0,60

Mechanical Properties - at room temperature - annealed, cold drawn condition

0,2 % yield strength	tensile strength	elongation (A5)
N/mm2 205 min.	N/mm2 520 min.	% 30 min.

Specification:

Seamless Pipes/Tubes:	ASTM-B-407
Welded Pipes/Tubes:	ASTM-B-514/515
Plates/Sheets:	ASTM-B-443
Bars:	ASTM-B446
Fittings:	ASTM-B-366
Flange:	ASTM-B-564
Specific weight:	7,95 kg/dm3
Melting range:	1355 - 1385° C
Welding methods:	Arc welding, TIG, MIG, autogenous welding, without thermal retreatment (details on request)
Machineability:	Table on request
Corrosion resistance:	Refer to table "Corrosion Data"
Product forms:	Tubes and pipes. fittings, flanges, plates and sheets bars, forgings and wire
Range of application:	Techalloy 800 is mainly employed for all equipment and heating tubes in the furnace-building industry, in the petrochemical industry, Techalloy 800 is used for heat exchangers and other piping systems; in the plastics, chemical and food industry, where, due to chlorid-ions, great demands are made on the stress corrosion cracking resistance, Techalloy 800 is also used for steamgenerator tubing in nuclear power plants and as sheathinon electric heating elements in domestic appliances etc.



Techalloy 800H

UNS NO. N08810, DIN W.NR. 1.4876

Techalloy 825 is a thermally stabilized alloy which is resistant to both inorganic and organic acids. It has excellent resistance to oxidizing and nonoxidizing hot acid conditions and at temperatures up to the boiling point it is resistant to many acids and alkaline solutions.

Chemical Composition in %

C	Si	Mn	Fe	Cr	Ni	S	Cu	Al	Ti
0,05- 0,10	1,0 max.	1,5 max.	Rest	19,0- 23,0	30,0- 35,0	0,015 max.	0,75 max.	0,15- 0,60	0,15- 0,60

Mechanical Properties - at room temperature - annealed condition, cold drawn

0,2 % yield strength	tensile strength	elongation (A5)
N/mm2 170 min.	N/mm2 450 min.	% 30 min.

Specification:

Seamless Pipes/Tubes: ASTM-B-407

Welded Pipes/Tubes: ASTM-B-514/515

Plates/Sheets: ASTM-B-409

Bars: ASTM-B-408

Fittings: ASTM-B-366

Flange: ASTM-B-564

Specific weight: 7,95 kg/dm3

Melting range: 1335- 1385° C

Welding methods: Arc welding and common welding processes

Machineability: Table on request

Range of application: Techalloy 800H is employed where maximum creep-rupture strength is required.



Techalloy 825

UNS NO. N08825, DIN W.NR. 2.4858

Techalloy 825 is a thermally stabilized alloy which is resistant to both inorganic and organic acids. It has excellent resistance to oxidizing and nonoxidizing hot acid conditions and at temperatures up to the boiling point it is resistant to many acids and alkaline solutions.

Chemical Composition in %

C	Si	Mn	Fe	Cr	Ni	S	Mo	Cu	Al Ti
0,025 max.	0,5 max.	1,0 max.	Rest	19,5-23,5	38,0--46,0	0,03 max.	2,5-3,5	1,5-3,0	0,2 max. 0,6-1,2

Mechanical Properties - at room temperature - annealed condition, cold drawn

0,2 % yield strength	tensile strength	elongation (A5)
N/mm2	N/mm2	%
241 min.	586 min.	30 min.

Specification:

Seamless Pipes/Tubes: ASTM-B-423

Welded Pipes/Tubes: ASTM-B-704/705

Plates/Sheets: ASTM-B-424

Bars: ASTM-B-425

Fittings: ASTM-B-366

Flange: ASTM-B-564

Specific weight: 8,14 kg/dm3

Melting range: 1370 - 1400° C

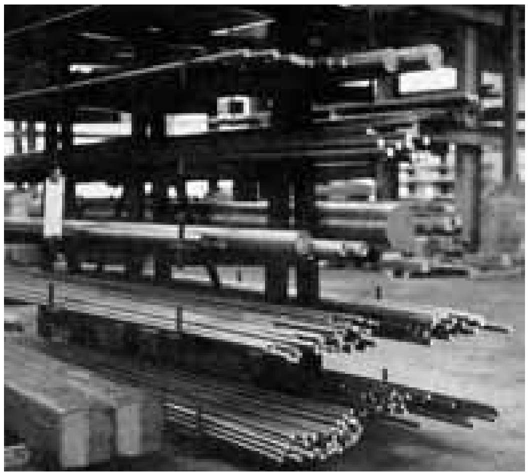
Welding methods: Arc welding, TIG, MIG, plasma, autogenous welding (Details on request)
Note: Take care that the surface is cleaned before welding

Machineability: Table on request

Corrosion resistance: Refer to table "Corrosion Data"

Product forms: Tubes and pipes, fittings, flanges, plates and sheets, bars, forgings

Range of application: Techalloy 825 is employed for phosphoric acid evaporators, pickling vats, plants for chemical processing, propeller shafts, transportation means for corrosive media etc.





Techalloy B-2

UNS NO. N10665, DIN W.NR. 2.4617

Techalloy B-2 is the further development of Techalloy B and has the same excellent corrosion resistance to boiling hydrochloric acid/hydrogene chloride and boiling sulfuric acid (up to a concentration of 60 %). Techalloy B-2 is resistant to carbide grain boundary separations in the heat-influenced welding zone so that it can be employed for most chemical applications without heat-treatment. Techalloy B-2 is furthermore resistant to stress corrosion cracking as well as pitting corrosion.

Chemical Composition: in %

C	Si	Mn	Fe	Cr	Ni	S	P	Mo	Co
0,02 max.	0,10 max.	1,0 max.	2,0 max.	1,0 max.	Rest	0,03 max.	0,04 max..	26-30	1,0 max.

Mechanical Properties - at room temperature - solution annealed condition

0,2 % yield strength	tensile strength	elongation (A5)
N/mm2 352 min.	N/mm2 760 min.	% 40 min.

Specification:

Seamless Pipes/Tubes: ASTM-B-622

Welded Pipes/Tubes: ASTM-B-619/626

Plates/Sheets: ASTM-B-333

Bars: ASTM-B-335

Fittings: ASTM-B-366

Flange: ASTM-B-564

Specific weight: 9,217 kg/dm3

Welding methods: Arc welding, TIG (Details on request)

Machineability: Details on request

Corrosion resistance: Refer to table TECHALLOY B-2

Product forms: Tubes and pipes, plates and sheet, bars, wire, fittings and flanges

Range of application: Techalloy B-2 is especially suited for applications conveying hydrochloric acid gas, sulfuric acid, acetic acid and phosphoric acid.





Techalloy C-276

UNS NO. N10276, DIN W.NR. 2.4819

Techalloy C-276 is the improved version of Techalloy C and is resistant to numerous media including strongly oxidizing chemicals (for example iron and cupric chloride) warm polluted acids, solvents, chloride and media contaminated by chloride (organic and inorganic), dry chloride, formic and acetic acid, acetic anhydride, sea water and saline solutions. Furthermore, Techalloy C-276 is resistant when exposed to damp chlorine gas, hypochlorite and chlorodioxide solutions. Techalloy C-276 combines this excellent corrosion resistance with immensely improved machineability. This alloy does not separate grain boundaries in the zone influenced by welding so that it is suited for most chemical applications even without heat-treatment.

Chemical Composition: in % max.

C	Si	Mn	Fe	Ni	Cr	S	p	Mo	W	Co	V
0,01 max.	0,08 max.	1,0 max.	4-7	57 Rest	14,5-16,5	0,03 max.	0,04 max.	15-17	3-4,5	2,5 max.	0,35 max.

Mechanical Properties - at room temperature - solution annealed condition

0,2 % yield strength	tensile strength	elongation (A5)
N/mm2 283 min.	N/mm2 690 min.	% 40 min.

Specification:

Seamless Pipes/Tubes:	ASTM-B.622
Welded Pipes/Tubes:	ASTM-B-619/626
Plates/Sheets:	ASTM-B-575
Fittings:	ASTM-B-366
Flange:	ASTM-B-564
Specific Weight:	8,88 kg/dm3
Melting range	ca. 1323° Celsius
Welding methods:	Arc welding. TIG (Details on request)
Machineability	Table on request
Corrosion resistance	Refer to table TECHALLOY C-276
Product forms:	Tubes and pipes. sheets and plates. bars. wire and forgings, fittings and flanges



Techalloy C-4 is a relatively new Ni-Cr-Mo alloy with improved resistance at high temperatures. Even when used for a long period of time in the temperature range of 650 - 1050° Celsius, this alloy retains its high ductility and corrosion resistance; furthermore it is highly resistant to grain boundsary separation in the heat-treated zone influenced by welding. Thus it can be employed without heatretreatment. Techalloy C-4 is also highly resistant against stress corrosion cracking and oxidizing atmospheres at temperatures up to 1050° Celsius.

Chemical Composition in %

C	Si	Mn	Fe	Cr	Ni	S	P	Mo	Co	Ti
0,015 max.	0,08 max.	1,0 max.	3,0 max.	14-18	Rest	0,03 max.	0,04 max.	14-17	2,0 max.	0,70 max.

Mechanical Properties - at room temperature - solution annealed condition

0,2 % yield strength	tensile strength	elongation (A5)
N/mm2 276 min.	N/mm2 690 min.	% 40 min.

Specification:

Pipes/Tubes: ASTM-B.622

Welded Pipes/Tubes: ASTM-B-619/626

Plates/Sheets ASTM-B-575

Fittings: ASTM-B-366

Flange: ASTM-B-564

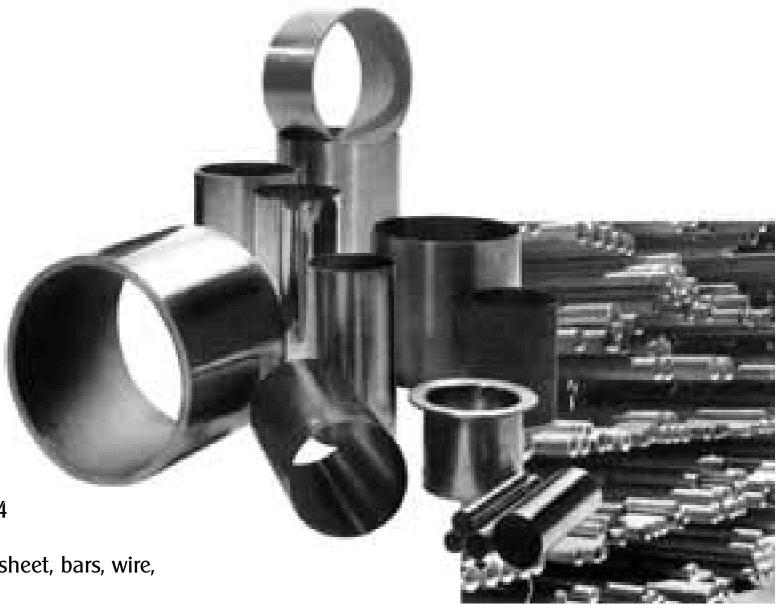
Specific weight: 8,64 kg/dm3

Welding methods: Arc welding,
TIG (Details on request)

Machineability: Details on request

Corrosion resistance: Refer to table TECHALLOY C-4

Product forms: Tubes and pipes, plates and sheet, bars, wire, forgings, fittings and flanges



Techalloy G3

UNS NO. N06985, DIN W.NR. 2.4619

Techalloy G3 is an Ni-Cr-Fe alloy with molybdenum and copper additions. This alloy is similar to Techalloy G. Techalloy G3 has excellent corrosion resistance to oxidizing chemicals. Due to its nickel and copper content, it is furthermoreresistant to reducing chemicals. Techalloy G3 is very suited for evaporators, heat exchangers in air pollution control systems, tank liners etc.

Chemical Composition in %

Ni	Cr	Fe	Mo	Cu	Nb/Ta	C
Rest	21,0-23,0	18,0-21,0	6,0 - 8,0	1,5 - 2,5	0,50 max.	0,015 max.
W	**Si**	**Mn**	**P**	**S**	**Co**	
1,5 max.	1,0 max.	1,0 max.	0,04 max.	0,03 max.	5,0 max.	

Mechanical Properties - at room temperature - annealed condition

0,2 % yield strength	tensile strength	elongation (A5)
N/mm2 241 min.	N/mm2 621 min.	% 40,0 min.

Specification:

Pipes/Tubes:	ASTM-B-622
Welded Pipes/Tubes:	ASTM-B-619/626
Sheets/Plates:	ASTM-B-582
Fittings:	ASTM-B-366
Flange:	ASTM-B-564
Specific weight:	8,30 kg/dm3
Welding Methods:	Arc welding
Machineability:	Details on request
Product forms:	Tubes and pipes, sheets, plates and strips, bars, fittings and flanges
Range of application:	Flue gas desulfurization systems, air pollution control systems, evaporators, heat exchangers, tank liners etc.



Techalloy DS

DIN W.NR. 1.4864

Techalloy DS is a heat-resistant Ni-Cr-Fe alloy with Si-addition for the employment at high temperatures where sufficient strength and corrosion resistance are required. Techalloy DS is heat-resistant up to 1100° Celsius when in fresh air. This alloy is especially resistant against changing oxidizing/reducing conditions as well as against the formation of sigma phase in the critical temperature range of 590 to 870° Celsius. Furthermore it is resistant to green rot. Due to the high strength and heat resistance of Techalloy DS, smaller sections than usual can be manufactured from this material.

Chemical Composition: in %

C	Si	Mn	Fe	Cr	Ni	Cu	Ti	S
0,1 max.	1,9-2,6	0,8-1,5	Rest	17,0-19,0	34,5-41,0	0,5	0,20 max.	0,03 max.

Mechanical Properties - at room temperature - annealed condition

0,2 % yield strength	tensile strength	elongation
N/mm2 363 min.	N/mm2 687 min.	% 50 min.

Specification:

Pipes/Tubes:	BS 3074 NA 17
Plates/Sheets:	BS 3072/3073 Na 17
Specific weight:	7,92 kg/dm3
Melting range:	1330 - 1400° Celsius
Welding methods:	Arc welding. TIG, MIG, plasma, autogenous welding (Details on request)
Machineability:	Table on request
Product forms	Tubes and pipes. plates and sheets, bars. forgings
Range of application:	Techalloy DS is mainly employed for all equipment and heating tubes in the furnace-building industry, it is used in a multiplicity of heat-treatment applications, i.a. for thermocouple element shield tubes etc.





Techalloy 20

UNS NO. N08020

Techalloy 20 is a high-alloyed stainless steel. Its corrosion properties surpass those of usual stainless qualities. For example, Techalloy 20 has excellent stress corrosion resistance to boiling 20-40% sulfuric acid. Although Techalloy 20 was originally developed for usage in sulfuric environments. Its range of application has been steadily extended and today also includes machining of artificial rubber, plastics, synthetic fibers etc. In pharmaceutical and food-producing applications, where purity has to be guaranteed. Techalloy 20 is employed to prevent metallic contamination. The most important advantages of this grade are its excellent mechanical properties as well as its comparatively easy machineability.

Chemical Composition: in %

C	Si	Mn	Cr	Ni	S	P	Mo	Cu	Cb&Ta	Fe
0.07 max.	1.0 max.	2.0 max.	19-21	32.0-38.0	0.035 max.	0.045 max.	2-3	3-4	8xC min. 1.0 max.	Rest

Mechanical Properties – at room temperature – annealed condition

0.2% yield strength	tensile strength	elongation (A5)
N/mm2 241 min.	N/mm2 551 min.	% 30 min.

Specification:

Seamless Pipes/Tubes:	ASTM-B-729
Welded Pipes/Tubes:	ASTM-B-464/468
Plates/Sheets:	ASTM-B-463
Bars:	ASTM-B-472/473
Fittings:	ASTM-B-366
Flange:	ASTM-B-564
Specific weight:	8.06 kg/dm2
Welding methods:	Arc welding
Product forms:	Tubes and pipes, sheets and plates, bars, wire, forgings
Range of application:	Heat-exchangers, pickling vats, pump shafts.



Techalloy B-2 Corrosion Data

Media	Concentration percent by weight	Average Penetration Rate per year mils	mm	Media	Concentration percent by weight	Average Penetration Rate per year mils	mm
	10	0.5	‹0.02		10	2	0.05
	30	0.4	0.01	Phosporic	30	3	0.05
Acetic Acid	50	0.4	0.01	Acid	50	6	0.15
	70	0.3	‹0.01	(Chemically Pure)	85	25	0.63
	99 (Glacial)	0.3	‹0.01				
	10	0.3	‹0.01				
	20	0.6	‹0.02				
Formic Acid	30	0.7	‹0.02		2	0.5	‹0.02
	40	0.7	‹0.02		5	3	0.08
	60	0.5	‹0.02		10	2	0.05
	89	0.5	‹0.02	Sulfuric Acid	20	0.7	‹0.02
				30	0.7	‹0.02	
				40	0.9	‹0.03	
	1	0.8	0.02		50	1	0.03
	2	3	0.08		50	2**	0.05**
Hydrochloric	5	5	0.13		50	1****	0.03***
Acid	10	7	0.18		60	2	0.05
	15	11	0.28		70	9	0.23
	20	15	0.38				
	20	20**	0.51**				

* Determined in laboratory tests of 120 hours duration. It is recommended that samples be tested under actual plant conditions. All test specimens were heat-treated at 1950°F (1066°C), water quenched unless otherwise noted.
** As gas tungsten arc welded
*** Aged 48 hours at 1000°F (538°C)

Techalloy C-276

Media	Concentration percent by weight	Test Temp.°F (°C)	Penetration Rate, per year: Unwelded** mils	Unwelded** mm	As-welded*** mils	As-welded*** mm	Welded and Heat-treated** mils	Welded and Heat-treated** mm
Chromic Acid	10	Boiling	65	1,65	81	2.06	43	1.09
Formic Acid	20	Boiling	4.8	0.12	3.5	0.09	3.6	0.09
Hydrochloric Acid	10	150 (66)	21	0.53	20	0.51	21	0.53
Hydrochloric Acid	10	167 (75)	40	1.02	50	1.27	-	-
Hydrochloric Acid	10+0.1 FeCl3	167 (75)	39	0.99	45	1.14	-	-
Hydrochloric Acid	10+0.5 NaOCl	167 (75)	46	1.17	50	1.27	-	-
Hydrochloric Acid	3.5+8 FeCl3	190 (88)	-	-	5	0.13	-	-
Hydrochloric Acid	1.0+25 FeCl2	200 (93)	-	-	45	1.14	-	-
Hydrochloric Acid	0.1+2.5 FeCl2	150 (66)	-	-	nil	nil	-	-
Nitric Acid	10	Boiling	16	0.41	17	0.43	17	0.43
Nitric Acid	10+3 HF	158 (70)	350	8.89	380	9.65	-	-
Sulfuric Acid	10	Boiling	15	0.38	14	0.36	18	0.46
Sulfuric Acid	85	167 (75)	17	0.43	17	0.43	-	-
Wet Chlorine (a)	-	150 (66)	0.5	0.01	-	-	-	-
Wet Chlorine (a)	-	175 (80)	0.6	0.02	-	-	-	-

* Determined in laboratory test. It is recommended that samples be tested under actual plant conditions.
** Solution heat-treated
*** Gas tungsten-arc welded.
(a) Average of two specimens. Test period was 210 hours.

Techalloy C4

Media	Concentration percent by weight	Test °F (°C)	Average Penetration Rate per year: Unwelded** mils	Unwelded** (mm)	As-Welded*** mils	As-Welded*** (mm)	Aged**** mils	Aged**** (mm)
Formic Acid	20	Boiling	2.9	(0.07)	3.5	(0.09)	3.5	(0.09)
Hydrochloric Acid	10	167 (75)	36	(0.91)	34	(0.86)	35	(0.89)
Nitric Acid	10	Boiling	5.9	(0.15)	7.1	(0.18)	9.2	(0.23)
Phosphoric Acid	85	Boiling	61	(1.55)	52	(1.32)	85	(2.16)
Sulfuric Acid	10	Boiling	22	(0.56)	25	(0.64)	20	(0.51)
Sulfuric Acid	85	167 (75)	23	(0.58)	17	(0.43)	21	(0.53)

* Determined in laboratory tests. It is recommended that samples be tested under actual plant conditions
** Heat-treated at 1950°F (1066°C), water quenched.
*** Gas tungsten-arc welded.
**** Aged 100 hours at 1650°F (899°C)

Corrosion Data

The following table summarises the typical resistance of various nickel base alloys to a wide range of corrosive environments. When using the table the following points should be borne in mind:

1: Data are summarised in this way for guidance only to show:
  i: The most suitable alloy for a given environment bearing in mind that no allowance is made for the effects of heat transfer, erosion, galvanic effects or the influence of minor impurities present in mixtures.

2: Materials are rated according to the detemined corrosion rate in a particular environment:

A= Corrosion rate less than 0-1 mm/a.
B= Corrosion rate less than 0-5 mm/a but greater than 0-1 mm/a.
C= Corrosion rate greater than 0-5 mm/a.

Corrosion rates less than 0-5 mm/a (A and B rating) are acceptable for most chemical and process plant.

3: The information should not be taken as an implied recommendation for the use of a particular material in a specific environment. It should not be a substitute for in plant trials with sample test coupons.

4: Concentrations refer to aqueous solutions or mixtures of gases in air.
5: Environments are listed in alphabetical order.
6: This data is typical of results obtained in these environments. However, these alloys are not limited to the corrosives, temperatures or concentrations given.

N.B. The A rating can be misleading in that very often the corrosion rate is very much less than 0-1 mm/a. Where thin-walled material is to be used and only very low corrosion rates can be tolerated, more precise corrosion data should be obtained.

Media	Concen-tration %	Temper-ature °C	Nickel 200 & 201	Techalloy 400	Techalloy 600	Techalloy 800	Techalloy 825
Acetaldehyde	99	40	A	A	A	A	A
Acetic Acid	0-99	30	C	B	B	A	A
Acetic Anhydride	100	30	B	B	B	A	A
Acetone	0-100	100	A	A	A	A	A
Acetylene	100	150	A	-	-	A	A
Acrolein	100	100	B	B	B	B	B
Air 100	-	A	A	A	A	A	A
Alcohol-Allyl	100	30	A	A	A	A	A
Ethyl	100	30	A	A	A	A	A
Methyl	100	30	A	A	A	A	A
Allyl Chloride	100	30	A	A	B	B	A
Aluminium Chloride	0-30	30	B	B	B	C	B
AluminiumSulphate (Alum.)	100	30	C	B	C	B	A
Ammonia Liquid	0-100	30	C	C	B	A	A
Ammonium Bicarbonate	0-100	100	-	-	-	B	B
Ammonium Carbonate	0-20	30	-	-	-	C	B
Ammonium Chloride (dry)	0-20	20	-	-	-	A	A
	100	100	B	B	B	C	B
Ammonium Hydroxide	0-30	70	-	C	-	A	A
Ammonium Nitrate	0-40	80	-	-	-	A	A
Ammonium Phosphate	5	100	B	B	B	A	A
Ammonium Sulphate	0-40	100	B	B	B	B	A
Amyl Acetate	100	30	A	A	A	A	A
Amyl Choride	100	30	A	B	B	B	B
Aniline	100	30	C	C	B	A	A
Barium Chloride	0-40	100	B	B	B	B	B
Barium Hydroxide	100	1040	B	-	B	B	A
	0-50	100	A	B	B	B	A
Beer	-	30	A	A	A	A	A
Beet Sugar Liquors	0-40	30	A	A	A	A	A
Benzaldehyde	100	30	B	B	B	A	A
Benzene	100	30	A	A	A	A	A
Black Sulphate Liquor	100	100	-	-	A	B	A
Boric Acid	0-20	100	B	B	B	A	A
Bromine, Dry	100	50	A	A	A	B	B
Butadiene	100	30	A	A	A	A	A
Butane	100	30	A	A	A	A	A
Butyl Acetate	100	30	B	B	B	A	A
Butyric Acid	0-100	100	C	B	C	B	A
Calcium Chloride	0-25	30	A	A	A	B	A
Calcium Hydroxide	0-30	100	B	B	B	B	B
Cane Sugar Liquors	100	90	A	A	A	A	A
Carbon Bisulphide	100	30	A	B	A	A	A
Carbon Dioxide	100	450	A	A	A	A	A
Carbon Tetrachloride	100	30	A	B	A	A	A
Caustic Soda		See Sodium Hydroxide					
Chlorine, Dry	100	550	B	B	A	A	C
Chlorobenzene	100	30	A	B	B	B	B
Chlorosulphonic Acid	100	30	B	B	B	-	B

Media	Concen-tration %	Temper-ature °C	Nickel 200 & 201	Techalloy 400	Techalloy 600	Techalloy 800	Techalloy 825
Chloroform	100	100	A	A	A	A	A
Chromic Acid	0-100	30	C	C	C	C	B
Citric Acid	100	30	B	B	B	B	A
Coffee	-	100	A	A	A	A	A
Copper Sulphate	0-30	100	C	C	C	B	A
Cresylic Acid	100	30	B	B	B	B	B
Dichlorethane	100	30	A	A	A	B	A
	100	700	-	-	A	A	-
Ethyl Acetate	100	30	B	B	B	B	A
Ethyl Cellulose	All	30	B	B	B	B	A
Ethyl Chloride	100	30	A	A	A	A	A
Ethylene Dichloride	100	30	A	A	A	B	A
	100	700	-	-	A	A	-
Ethylene Glycol	100	30	B	B	B	A	A
Fatty Acids	100	30	A	A	A	A	A
Ferric Chloride	100	30	C	C	C	C	B
Ferric Nitrate	100	30	C	C	C	B	A
Ferric Sulphate	0-30	30	C	B	C	B	A
Fluoboric Acid	25	30	B	B	B	B	B
Fluosilicic Acid	20	30	B	C	B	B	B
Formaldehyde	0-100	30	A	A	A	A	A
Formic Acid	0-100	100	B	B	B	C	A
Fuel Oil	100	30	C	A	C	A	A
Furfural	30-100	100	B	B	B	B	A
Gelantine	0-40	50	B	B	A	A	A
Glucose	All	30	A	A	A	A	A
Glutamic Acid	All	30	B	B	B	B	A
Glycerine	100	30	A	A	A	A	A
Glycerol	0-100	150	A	A	A	A	A
High Temperature Salt (nitrate/nitrite)	-	500	A	-	A	A	-
Hydraulic Oil	-	-	A	A	A	A	A
Hydrazine	100	35	C	C	C	C	C
Hydrobromic Acid	-	-	C	C	C	C	C
Hydrochloric Acid	0-37	35					
Hydrocyanic Acid	100	35	C	C	A	A	A
Hydrofluoric Acid	10-100	35	B	A	B	C	B
	100	350	B	B	B	C	B
Hydrogen Peroxide (acid free)	All	30	B	B	B	A	A
Hydrogen Sulphide	0-20	150	-	B	-	B	A
Hydroquinone	All	35	B	B	A	-	A
Insulin	100	35	A	A	A	A	A
Lactic Acid	80	30	C	C	B	B	A
Lead Acetate	20	30	B	B	A	A	A
Lemon Juice	All	30	A	B	A	B	A
Linseed Oil	100	30	A	A	A	A	A
Lithium Chloride	All	30	A	A	A	A	A
Lithium Hydroxide	10	30	A	A	A	A	A
Magnesium Carbonate	All	30	A	A	A	A	A
Magnesium Chloride	0-50	30	A	A	A	A	A
Magnesium Hydroxide	All	30	A	A	A	A	A
Magnesium Nitrate	All	30	C	C	B	A	A
Magnesium Sulphate	30	30	B	A	A	A	A
Maleic Acid	All	30	B	B	B	B	A
Mercuric Chloride	All	30	C	C	C	C	C
Mercuric Cyanide	All	30	C	C	C	C	B
Mercuric Iodide	All	30	C	C	C	C	C
Mercurous Nitrate	All	30	C	C	B	A	A
Mercury	All	100					
Methyl Alcohol	0-100	100	A	A	A	A	A
Methyl Chloride	100	30	A	A	A	A	A
Methyl Ethyl Ketone	All	100	B	B	B	A	A
Milk	All	30	B	B	A	A	A
Mine Water	All	65	C	C	A	A	A
Molasses	All	30	A	A	A	A	A
Mono (sodium, potassium or ammonium) Phosphate	All	30	A	A	A	A	A
Naphthenic Acid	100	30	B	A	A	A	A
Nickel Chloride	All	30	B	B	B	B	A
Nickel Nitrate	All	30	C	C	B	B	A
Nickel Sulphate	All	30	B	B	B	B	A
Nitric Acid	0-65	30	C	C	B	A	A
	100	80	C	C	C	B	A
Nitrobenzene	100	100	B	B	B	B	B
Oils, Crude	100	30	A	A	A	A	A
Oils, Essential	100	30	A	A	A	A	A

Media	Concen-tration %	Temper-ature °C	Nickel 200 & 201	Techalloy 400	Techalloy 600	Techalloy 800	Techalloy 825
Oils, Mineral	100	30	A	A	A	A	A
Oils, Palm	100	30	A	A	A	A	A
Oils, Peanut	100	30	A	A	A	A	A
Oils, Sulphonated	100	30	A	A	A	A	A
Oils, Vegetable	100	30	A	A	A	A	A
Oleic Acid	100	30	B	B	A	A	A
Oleum	20	30	C	C	A	B	A
Orange Juice	All	30	A	A	A	A	A
Oxalic Acid	All	30	C	B	B	C	B
Oxidising gases	100	°C	1000	550	1100	1100	900
Palmitic Acid	100	30	A	A	A	A	A
Paraffin	100	35	A	A	A	A	A
Petrol	100	30	A	A	A	A	A
Phenol	100	30	A	B	A	A	A
Phenol Sulphonic Acid	100	30	B	B	B	B	A
Phosphoric Acid	0-25	30	B	A	A	B	A
	25-85	85	A	A	C	C	A
Phthalic Anhydride	100	30	B	A	A	B	A
Picric Acid	100	30	C	C	C	C	B
Potassium Bicarbonate	0-30	30	A	A	A	A	A
Potassium Carbonate	All	30	A	A	A	A	A
Potassium Chlorate	All	30	B	B	B	B	A
Potassium Chloride	All	30	A	A	A	A	A
Potassium Chromate	0-30	30	A	B	A	B	A
Potassium Cyanide	0-30	100	B	-	B	B	B
Potassium Dichromate	0-20	30	B	B	B	B	A
Potassium Ferricyanide	0-30	30	B	B	B	B	B
Potassium Hydroxide	0-50	30	A	A	B	B	B
	0-50	100	A	A	B	B	B
Potassium Nitrate	All	30	B	B	B	A	A
Potassium Sulphate	10	30	B	B	A	A	A
Propane	100	100	A	A	A	A	A
Salicylic Acid	All	30	A	A	A	A	A
Sea Water	100	100	A	A	A	A	A
Silicon Tetrachloride	100	30	A	A	A	B	A
Silver Nitrate	All	30	C	C	B	B	B
Soap	100	30	A	A	A	A	A
Sodium Acetate	All	30	B	B	B	B	A
Sodium Bicarbonate	All	30	B	B	B	B	A
Sodium Bisulphate	10	30	B	A	B	B	A
Sodium Bromide	0-50	30	B	B	B	B	B
Sodium Carbonate	30	A	B	B	B	B	A
Sodium Chloride	All	30	B	A	B	A	A
Sodium Hydroxide	0-50	30	A	A	A	A	A
	50-75	30	A	A	A	B	A
Sodium Metaphosphate	All	30	B	B	A	B	A
Sodium Metasilicate	0-50	30	A	A	A	A	A
Sodium Nitrate	10	30	B	B	A	A	A
	All	30	B	B	A	A	A
Sodium Peroxide	100	100	B	B	B	C	B
Sodium Phosphate	All	30	A	A	A	A	A
Sodium Sulphate	All	30	A	A	A	A	A
Sodium Sulphide	All	30	B	B	A	B	A
Steam	100	450	A	A	A	A	A
Stearic Acid	All	30	A	A	A	A	A
Sugar (liquid)	All	30	A	A	A	A	A
Sulphuric Acid	0-15	30	B	A	B	B	A
	15-75	30	C	B	C	B	A
	75-96	30	C	C	C	C	A
Sulphurous Acid	0-60	100	-	-	-	C	B
Tall Oil	100	30	A	A	A	A	A
Tannic Acid	10	30	B	B	B	B	B
Tartaric Acid	58	30	B	B	B	B	A
Tetraphosphoric Acid	100	30	C	C	B	-	A
Toluene	100	100	A	A	A	A	A
Trichloroethylene	100	100	A	A	B	B	B
Turpentine	100	30	A	A	A	A	A
Urea	50-100	375	-	-	B	B	A
Vinegar	100	30	A	A	A	B	A
Vinyl Chloride	100	30	A	A	A	A	A
Water	100	100	A	A	A	A	A
Xylene	100	100	B	B	A	B	A
Zinc Ammonium Chloride	0-40	100	-	B	B	C	B
Zinc Chloride	0-100	30	B	B	B	C	B
Zinc Nitrate	10	30	C	C	B	B	A
Zinc Sulphate	20	30	B	B	B	B	A

Chemical composition, mechanical properties and heat treatment

Titanium tubes

ASTM Grade (sim. DIN Grade)	Chemical Composition N % max	C % max	H % max	Fe % max	O % max	Al % max	V % max	Pa	Mo	Ni
ASTM B 338 Grade 1	0,03	0,08	0,015	0,20	0,18	-	-	-	-	-
DIN 17861 Ti 1 - 3.7025	0,05	0,06	0,013*	0,15	0,12	-	-	-	-	-
VdTÜV 230/2										
ASTM B 338 Grade 2	0,03	0,08	0,015	0,30	0,25	-	-	-	-	-
DIN 17861 Ti2 - 3.7035	0,05	0,06	0,013*	0,20	0,18	-	-	-	-	-
VdTÜV 230/2										
ASTM B 338 Grade 3	0,05	0,08	0,015	0,30	0,35	-	-	-	-	-
DIN 17861 Ti 3 - 3.7055	0,05	0,06	0,013*	0,25	0,25	-	-	-	-	-
VdTÜV 230/2										
ASTM B 338 Grade 7	0,03	0,08	0,015	0,30	0,25	-	-	0,12 - 0,25	-	-
DIN 17861 Ti 2 Pd - 3.7235	0,05	0,06	0,013*	0,20	0,18	-	-	0,05 - 0,25	-	-
VdTÜV 230/2										
ASTM B 338 Grade 9	0,02	0,08	0,015	0,25	0,15	2,5 - 3,5	2,0 - 3,0	-	-	-
ASTM B 338 Grade 11	0,03	0,08	0,015	0,20	0,18	-	-	0,12 - 0,25	-	-
DIN 17861 Ti1 Pd - 3.7225	0,05	0,06	0,013*	0,20	0,18	-	-	0,15 - 0,25	-	-
VdTÜV 230/2										
ASTM B 338 Grade 12	0,03	0,08	0,015	0,30	0,25	-	-	-	0,2 - 0,4	0,6 - 0,9
DIN 17861 Ti AL3V2,5 3.7195	0,04	0,05	0,015	0,30	0,12	2,5 - 3,5	2,0 - 3,0	-	-	-

** In case wallthickness is under 2 mm, the Hydrogen content up to 0,015% is allowed.*



	Mechanical properties and heat treatment							
	Residuals Each	Residuals Total	Titanium	Rp 0,2 N/mm2 min. max.	Rp 1,0 N/mm2 min.	Rm N/mm2 min. max.	A5 % min.	Heat Treatment
	0,1	0,4	Rem.	170 - 310	-	240 min.	24	annealed
	0,1	0,4	Rem.	180	200	290 - 410	30	soft annealed
	0,1	0,4	Rem.	275 - 450	-	345 min.	20	annealed
	0,1	0,4	Rem.	250	270	390 - 540	22	soft annealed
	0,1	0,4	Rem.	380 - 550	-	450 min.	18	annealed
	0,1	0,4	Rem.	320	350	460 - 590	18	soft annealed
	0,1	0,4	Rem.	275 - 450	-	345 min.	20	annealed
	0,1	0,4	Rem.	250	270	390 - 540	22	soft annealed
	0,1	0,4	Rem.	725	-	860	10	annealed
	0,1	0,4	Rem.	170 - 310	-	240	24	annealed
	0,1	0,4	Rem.	320	350	460 - 590	18	soft annealed
	0,1	0,4	Rem.	345	-	483	18	annealed
	0,1	0,4	Rem.	520	-	620 min.	15*	soft annealed

** Wall thickness under 1 mm 12%*



View of pilger process area

ASTM GRADES - ALLOY FEATURES

Grade 1 (unalloyed Titanium).......... used to increase formability.

Grade 2 (unalloyed Titanium)......... the most common Titanium grade for cooling water systems; good strength with high ductility, formability, weldability and corrosion resistance.

Grade 3 (unalloyed Titanium).......... specified when higher levels of strength are required.

Grade 7 (unalloyed Titanium) ...... enhanced resistance to hot brine crevice corrosion and reducing acids, mechanical properties similar to grade 2 alloy.

Grade 9 (Titanium alloy) .... offers excellent corrosion resistance to sea water and is medium-high strength alloy with highest code design allowables.

Grade 11 (unalloyed Titanium).......... mechanical properties are the same as those of grade 1 however, with greater resistance to corrosion against acid chlorides.

Grade 12 (Titanium alloy).............. more resistant even at temperatures up to 300°C with improved strength and code design allowables over grade 2.

Comparison of Common Titanium DIN- and ASTM Grades

A. Chemical Analysis						
	DIN Standard 3.7025	ASTM Standard Grade 1	DIN Standard 3.7035	ASTM Standard Grade 2	DIN Standard 3.7055	ASTM Standard Grade 3
Iron	0,15 % max.	0,20 % max.	0,20 % max.	0,30 % max.	0,25 % max.	0,30 % max.
Oxygen	0,12 % max.	0,18 % max.	0,18 % max.	0,25 % max.	0,25 % max.	0,35 % max.
Nitrogen	0,05 % max.	0,03 % max.	0,05 % max.	0,03 % max.	0,05 % max.	0,05 % max.
Carbon	0,06 % max.	0,08 % max.	0,06 % max.	0,08 % max.	0,06 % max.	0,08 % max.
Hydrogen	0,013 % max.	0,015% max.	0,013 % max.	0,015 % max.	0,013 % max.	0,015 % max.
Residuals	0,40 % max.	0,40 % max.	0,40 % max.	0,40 % max.	0,40 % max.	0,40 % max.
Titanium	balance	balance	balance	balance	balance	balance
B. Mechanical Properties (Annealed)						
Tensile Strength in MPA	290-410	240 Min.	390-540	345 Min.	460-590	450 Min.
Yield Strength in MPA	180 Min.	170-310	250 Min.	275-450	320 Min.	380-550
Elongation	30 % Min.	24 % Min.	22 % Min.	20 % Min.	18 % Min.	18 % Min.

Typical Tensile Properties and Hardness of Condenser Tube Materials

Material	Yield Strength (Mpa)	Tensile Strength (Mpa)	Hardness (Vickers)	Elongation Nitrogen (%)
Titanium Grade 2	334	432	145	40
18-8 Stainless Steel (annealed)	275	598	142	68
Aluminium Brass (annealed)	177	451	85	55
Admiralty Brass (annealed)	137	343	75	65
70-30 Cupronickel (annealed)	177	422	95	45
90-10 Cupronickel (annealed)	137	353	75	42

Comparison with other Materials

Material	Density kg/m 3	Melting point °C	Thermal conductivity W/(m.K)	Coefficient of thermal expansion	Modulus of elasticity Mpa	Electrical resistivity Ohm x m
Titanium	4505	1667	17	8.4×10^{-6}	106.4×10^{3}	55.0×10^{-8}
Monel	8800	1325	26	14.0×10^{-6}	179.5×10^{3}	48.0×10^{-8}
Nickel	8900	1453	92	15.0×10^{-6}	206.0×10^{3}	9.5×10^{-8}
Stainless Steel	7900	1410	16	17.0×10^{-6}	200.1×10^{3}	72.0×10^{-8}
Aluminium	2700	660	205	23.0×10^{-6}	69.2×10^{3}	2.7×10^{-8}
Brass	8400	970	100	18.5×10^{-6}	107.9×10^{3}	7.5×10^{-8}
Iron	7900	1530	63	12.0×10^{-6}	206.0×10^{3}	9.7×10^{-8}
Copper	8900	1083	385	17.0×10^{-6}	107.9×10^{3}	1.7×10^{-8}

Corrosion Resistance to Seawater

1 = Lowest
6 = Highest

	Titanium	304 Stainless Steel	90-10 CU-NI	Aluminium Brass	Admiralty Brass
Corrosion in General	6	5	4	3	2
Pitting (Flowing)	6	4	6	4	4
Pitting (Stagnant)	6	1	5	2	2
Stress Corrosion	6	5	6	1	1
Erosion Corrosion	6	6	4	2	2
Chloride Corrosion	6	1	6	5	3
Ammonia Corrosion	6	6	4	2	2
High Flow Speed	6	6	4	3	3
Impact of Steam (Tube Exterior)	6	6	3	2	2-1
Turbulence (Tube Interior)	6	6	3	(2)	2-1
Bio-Fouling	3	2	4	(5)	5
Total	63	48	49	31	27
(Average)	(5.7)	(4.4)	(4.5)	(2.8)	(2.5)



Titanium is a thermo dynamically active metal. Owing to a thin passive film formed on the surface, it has excellent corrosion characteristics and is resistant to most types of corrosives as listed in the following table:

Corrosives	Concentration (%)	Temperature (°C)	Corrosion resistance			
			Titanium	304 Stainless Steel	316 Stainless Steel	Nickelbase Alloy
Seawater	High flow speed	24	●	—	●*	—
	Stagnant Seawater	100	●*	—	—	●
Hydrochloric acid Hci	10	24	✷	■	■	●
	30	24	■	■	■	●
	10	80	■	—	—	✷
	30	80	■	—	—	▲
Nitric acid HNO 3	10	24	●	●	●	●
	50	24	●	●	●	—
	10	100	●	●	●	▲
	50	100	●	✷	✷	—
Sulphuric acid H_2SO_4	10	24	▲	—	✷	●
	50	24	■	■	■	●
	10	100	■	—	■	●
	50	100	■	—	■	●
Ferric Chloride $FeCl_3$	10	24	●	■	■	●
	30	24	●	■	■	●
	10	100	●	—	—	■
	30	100	●	—	—	■
Phosphoric acid $H3PO_4$	10 (Aerated)	24	✷	●	●	●
	50 (Aerated)	24	▲	●	●	●
	10 (Aerated)	100	■	●	●	●
	50 (Aerated)	100	■	✷	✷	●
Aqua Regia HCl—HNO_3	HCl—HNO_3	24	●	■	■	▲
	3:1	100	✷	—	—	—
Chromic acid CrO_3	5	24	●	—	✷	●
Hydrogen fluoride HF	5	30	■	■	■	▲
Ammonia NH_3	10	24	●	●	●	●
	30	24	●	●	●	●
	10	80	●	✷	✷	✷
	30	80	●	✷	✷	●
Chlorine Cl_2	Dry Gas	24	■	—	✷	●
	Wet Gas	24	●	—	■	▲
	Dry Gas	100	—	●	✷	✷
	Wet Gas	90	●	—	■	▲
Sodium Hydroxide NaOH	10	24	●	●	●	●
	50	24	●	●	●	—
	10	100	●	●	●	●
	50	100	✷	✷	✷	●
Formic acid HCOOH	10	24	✷	✷	●	●
	50	24	✷	✷	●	●
	10	100	✷	■	✷	●
	30	100	■	■	✷	●
Sodium Carbonate Na_2CO_3	10	24	●	●	●	●
	30	24	—	—	—	—
	10	100	●	●	●	●
	30	100	●	●	●	●

● = ‹ 0,051 mm/year ✷= ‹ 0,508 mm/year ▲ = 0,508 − 1,27 mm/year ■ = ›1,27 mm/year

-Notes- *Localized corrosion such pitting corrosion may occur.

Corrosives	Concentration (%)	Temperature (°C)	Corrosion resistance			
			Titanium	304 Stainless Steel	316 Stainless Steel	Nickelbase Alloy
Cupric Chloride $CuCl_2$	10	24	✷	■	■	✷
	30	24	✷	■	■	✷
	10	100	✷	–	–	–
	30	100	✷	–	–	–
Calcium Chloride $CaCl_2$	10	24	●	●	●	●
	50	24	●	✷	✷	●
	10	100	●*	–	–	●
	50	100	●*	■	–	●
Sodium Chloride NaCl	10	24	●	✷	✷	✷
	40	24	●	✷	✷	✷
	10	100	●*	✷*	✷*	✷
	40	100	●*	✷*	✷*	✷
Ammonium Chloride NH_4Cl	10	24	●	▲	●	●
	40	24	●	–	–	●
	10	100	●*	–	●*	●
	40	100	●*	–	–	●
Hydrogen sulfide H_2S	Dry Gas	24	●	▲	✷	●
	Wet Gas	24	●	✷	●	✷
Sulfur Dioxide SO_2	Dry Gas	30–60	●	–	–	–
	Wet Gas	30–90	●	–	–	–
Acetic acid CH_3 COOH	10	24	●	●	●	●
	60	24	●	●	●	●
	10	100	●	●	●	●
	60	100	●	✷	✷	●
Magnesium Chloride $MgCl_2$	10	24	●	▲	✷	●
	40	24	●	✷	✷	●
	10	100	●*	▲*	–	●
	40	100	●*	–	–	●
Ferrous Sulfate $FeSO_4$	10	24	●	✷	✷	✷
	50	24	●	✷	✷	✷
	10	100	●	✷	✷	✷
	50	100	●	–	–	✷
Lactic acid CH_3CH (OH) COOH	10	24	●	✷	●	✷
	50	24	●	✷	●	●
	10	100	●	✷	✷	✷
	50	100	●	■	✷	✷
Citric acid $C_6H_8O_7$	10	24	●	✷	●	●
	50	24	●	✷	●	●
	10	100	●	✷	●	●
	50	100	■	■	●	●
Oxalic acid (COOH)2	10	24	✷	✷	✷	✷
	20	52	■	–	–	✷
	50	24	–	✷	✷	✷
	10	100	–	–	■	✷
	50	100	–	■	■	✷

● = ‹ 0,051 mm/year ✷= ‹ 0,508 mm/year ▲ = 0,508 – 1,27 mm/year ■ = ›1,27 mm/year

-Notes- *Localized corrosion such pitting corrosion may occur.

Super-Duplex Stainless Steels and their characteristics

The first-generation Duplex stainless steels were developed more than 70 years ago in Sweden for use in the sulfite paper industry. Duplex alloy were originally created to combat corrosion problems caused by chloride-bearing cooling waters and other aggressive chemical process fluids.

Called Duplex because of its mixed microstructure with about equal proportions of ferrite and austenite, Duplex stainless steels are a family of grades, which range in corrosion performance depending on their alloy content. The term "Super-Duplex" was first used in the 1980`s to denote highly alloyed, high-performance Duplex steel with a pitting resistance equivalent of ›40 (based on Cr% + 3.3 Mo% + 16N%)

With its high level of chromium, Super-Duplex steel provides outstanding resistance to acids, acid chlorides, caustic solutions and other environments in the chemical / petrochemical, pulp and paper industries, often replacing 300 series stainless steel, high nickel superaustenitic steels and nickel-based alloys.

The chemical composition based on high contents of chromium, nickel and molybdenum improves intergranular and pitting corrosion resistance Additions of nitrogen promote structural hardening by interstitialsolid solution mechanism, which raises the yield strength and ultimate strength values without impairing toughness. Moreover, the two-phase microstructureguarantees higher resistance to pitting and stress corrosion cracking in comparison with conventional stainless steels.

From the introduction of its first-generation, Duplex steel has seen a steady increase in popularity. Recently, the production of highstrength, corrosion resistant super-duplex coil has been implemented in the marine and chemical industries, architecture and mast riggings, wire lines, lifting and pulley equipment and well service strands. In fact, development of wire processing techniques has enabled the production of steel wires down to 1 mm in diameter.

The various Alloys

Super-Duplex falls under the Duplex stainless steel grouping. Duplex stainless steels are graded for their corrosion performance depending on their alloy content. Today, modern Duplex stainless steel can be divided into four groups:

- . . . . . .Lean Duplex such as 2304, which contains no deliberate Mo addition:
- . . . . . .2205, the work-horse grade accounting for more than 80% of duplex usage;
- . . . . . .25Cr duplex such as Alloy 255 and DP-3;
- . . . . . .Super-Duplex; with 25-26 Cr and increased Mo and N compared 25 Cr grades, including such as 2507, Zeron 100, UR 52N+, and DP-3W







Composition of Duplex Stainless Steels [a]

The Table lists the duplex stainless steel covered in ASTM specifications for plate, sheet and bar products.

UNS Number Duplex Grades	Type [b]	C	Mn	P	S	Si	Cr	Ni	Mo	N	Cu	Other
S31200	...	0.030	2.00	0.045	0.030	1.00	24.0-26.0	5.5-6.5	1.20-2.00	0.14-0.20	...	...
S31260	...	0.03	1.00	0.030	0.030	0.75	24.0-26.0	5.5-7.5	2.5-3.5	0.10-0.20	0.20-0.80	W0.10-0.20
S31803	...	0.030	2.00	0.030	0.020	1.00	21.0-23.0	4.5-6.5	2.5-3.5	0.08-0.20	...	
S32001	...	0.030	4.0-6.0	0.040	0.030	1.00	22.0-23.0	1.00-3.00	0.60	0.05-0.17	1.00	
S32205	2205	0.030	2.00	0.030	0.020	1.00	19.5-21.5	4.5-6.5	3.0-3.5	0.14-0.20	...	
S32304	2304	0.030	2.50	0.040	0.030	1.00	21.5-24.5	3.0-5.5	0.05-0.60	0.05-0.20	0.05-0.60	
S32520	...	0.030	1.50	0.035	0.020	0.80	24.0-26.0	5.5-8.0	3.0-4.0	0.20-0.35	0.50-2.00	
S32550	255	0.04	1.50	0.040	0.030	1.00	24.0-27.0	4.5-6.5	2.9-3.9	0.10-0.25	1.5-2.5	
S32750	2507	0.030	1.20	0.035	0.020	0.80	24.0-26.0	6.0-8.0	3.0-5.0	0.24-0.32	0.50	
S32760	...	0.030	1.00	0.030	0.010	1.00	24.0-26.0	6.0-8.0	3.0-4.0	0.20-0.30	0.50-1.00	c
S32900	329 [d]	0.06	1.00	0.040	0.030	0.75	23.0-28.0	2.5-5.0	1.0-2.0	...	...	
S32950	...	0.03	2.00	0.035								

a . . .Weight percent, maximum unless otherwise noted.
b . . .Unless otherwise indicated, a common name, not a trademark, widely used, not associated with any one producer, as liste in ASTM A240.
c . . .W 0.50-1.00; Cr+3.3 Mo + 16N=40 min
d . . .AISI designation

BENEFITS

- High strength
- High resistance pitting, crevice corrosion resistance
- High resistance stress corrosion cracking, corrosion fatigue and erosion
- Excellent resistance to chloride stress-corrosion cracking
- High thermal conductivity
- Low coefficient of thermal expansion
- Good sulfide stress corrosion resistance
- Low thermal expansion and higher heat conductivity than austenitic steels
- Good workability and weldability
- High energy absorption

APPLICATIONS

- Heat exchangers, tubes and pipes for production and handling of gas and oil
- Heat exchangers and pipes in desalination plants
- Mechanical and structural components
- Power industry FGD systems
- Pipes in process industries handling solutions containing chlorides
- Utility and industrial systems, rotors, fans, shafts and press rolls where the high corrosion fatigue strength can be utilized
- Cargo tanks, vessels, piping and welding consumables for chemical tankers
- High-strength, highly resistant wiring

Material No. 1.4429 is a fullyaustenitic steel with an extremely low Carbon content. Like Material No. 1.4465 this steel has a guaranteed low Ferrite content, and it is used particularly in equipment of Urea plants which is likely to be subjected to corrosion.

1. Material description

DIN X 2 Cr Ni Mo N 17-13-3
Material No. (1.4429)
AISI (316L)
BS 316 S 12

2. Supply form and condition

seamless tubes, pickled
sheets, strips, rods, forgings

3. Range of dimension (Tubes)

Outside diameter ....10-114 mm
Wall Thickness ....1-12 mm
Length ....max. 18 m
(depending on diameter and wall)

4. Chemical composition

(nominal analysis in %)

C	Si	Mn	Cr	Ni	Mo	N
≤ 0.03	≤ 1.0	≤ 2.0	16.5-18.5	12.0-14.5	2.5-3.0	0.14-0.22

5. Mechanical properties

a. at room temperature

0.2 proof stress N/mm²	Tensile strength N/mm²	Elongation (A_5) %
≥ 300	600-800	≥ 35

b. at increased temperatures (minimum values)

Temperature °C	50	100	150	200	250	300	350	400	450	500	550
0.2-proof stress N/MM²	265	225	197	178	165	155	150	145	140	138	136
1%-proof stress N/MM²	300	260	227	208	195	185	180	175	170	168	166

6. Physical properties

Density	7.95 g/cm_
Electrical resistance	0.75 Ohm – mm_/m
Thermal conductivity	15 W/m°C

Temperature °C	20	100	200	300	400	500
Linear coefficient (106 m/m °C) of expansion		16.5	17.5	17.5	18.5	18.5
Modulus of elasticity (103 N/mm_)	200	194	186	179	172	165

7. Heat treatment

Quench annealing: 1150-1050 °C/water

8. Welding

The weldability of Material No. 1.4429 is as good as that of the known austenitic Cr-Ni-Mo steels. The TIG process and welding with rod electrodes are mainly used as welding processes. Welding additives, specially designed for this steel, are available, which produce a weld with limited, Ferrite content and low corrosion rates at the Huey-test. Heat treatment (pre-or subsequent heating) is generally not necessary.

The heat input during welding should be kept to a miniumum.

9. Cold bending

After cold bending to the usual bending radii heat treatment is not necessary.

At a higher degree of deformation and operational conditions, which may suggest danger of stress corrosion cracking, heat treatment at 1150-1050 °C with quenching is recommended.

10. Hot bending

The working tempertures should be in the region of 1150-750 °C and the parts should be quenched as quickly as possible after hot forming. Annealing is generally not necessary after the bending.

11. Corrosion resistance

a) Because of the special chemical composition and special procedures during production a better intercrystalline corrosion performance and a lesser corrosion rate in Carbamate solutions and at the Huey-test are obtained than with 316 L. The very low Ferrite content has also a decisive influence on the good corrosion performance.

b) Huey (Test Corrosion Rate)
max. 0,6 mm/y (13 g/m^2 24 h)

12. Application

In Urea plants Material No. 1.4429 is used in particular for the scrubber, condenser and line pipes.

Material No. 1.4439 is a fully austenitic chromium-nickel-molybdenum-steel with increased resistance to pitting corrosion

1. Material description

X2CrNiMoN 17135
Material No. 1.4439
(SEW 400)

2. Supply form and condition

seamless tubes, annealed
(plates, strips, rods, forgings)

3. Range of dimensions (Tubes)

Outside Diameter: . . . . .10-114 mm
Wall Thickness: . . . . .1-12 mm
Length: . . . . .max. 26.5 m
(depending on diameter and wall)

4. Chemical composition
(nominal analysis in %)

C	Si	Mn	P	S	Cr	Ni	Mo	N
≤0.04	≤1.00	≤2.00	≤0.045	≤0.03	16.5-18.5	12.5-14.5	4.0-5.0	0.10-0.20

5. Mechanical properties
a. at room temperature

0.2 proof stress N/mm²	1%-proof stress N/mm²	Tenile Strength N/mm²	Elongation (A5) %
≥ 285	≥ 315	590-780	≥40

b. at increased temperature
(minimum values)

Temperature in °C	100	150	200	250	300	350	400
0.2-proof stress N/mm²	225	200	185	175	165	155	150
1%-proof stress N/mm²	255	230	210	200	190	180	175

6. Physical properties

Density	7.9 g/cm_
Electrical resistance	0.85 Ohm mm_/m
Thermal conductivity	15 W/M°C
Linear coefficient of expansion	20-100°C 16.5 106 m/m°C
	20-200°C 17.5 106 m/m°C
	20-300°C 17.5 106 m/m°C
	20-400°C 18.5 106 m/m°C
Modulus of elasticity	200 103 N/mm^2

7. Heat treatment

Recrystallization	1050-1150 °C/air/water
Stress-relieving	500-600 °C/air

3. Range of dimensions (Tubes)

Outside Diameter: . . . . .10-114 mm
Wall Thickness: . . . . .1-12 mm
Length: . . . . .max. 26.5 m
(depending on diameter and wall)

8. Welding

Electrode rod welding as well as the WIG (TIG)-method is suitable for welding tubes into tube plates. The use of additives of the same type is recommended in order to obtain a weld free of ferrites and with the favourable properties of the basic material. Welding should be carried out with as little heat as possible. There is usually no need for further heat treatment.

9. Cold bending

Heat treatment is in most cases not necessary after cold bending to normal bending radii. At a higher degree of forming and at operational conditions which could cause stress corrosion in austenitic steels, a stress-relieving annealing is recommended.

10. Corrosion resistance

The addition of nitrogen provides a good austenitic stability for Material No. 1.4439 giving it a superior corrosion resistance to that of 1.4435. Even after heat treatment e.g. welding, a good corrosion resistance is maintained as there is no possiblity of the formation of harmful phases e.g. the sigma phase. The increased molybdenum content affords a high corrosion resistance in chlorine-ion-containing media. Pitting corrosion resistance is particularly improved.

Material No. 1.4439 is characterized by good resistance in

Mixed acids	-sulphuric acid / nitric acid,Hydrofluoric acid / nitric acid
Bleaching solutions	-sodium chlorite, sodium-hypochlorite
Sea and brackish water	-sodium chloride

11. Application

Positive experiences with Material No. 1.4439 can be expected amongst others in the following applications:

Fatty acid plants
Bleaching plants
Nuclear evaporation plants
Plants admitting aqueous chloride solutions

Material No. 1.4417 is a ferritic-austenitic chromium-nickel-molybdenum steel of increased yield point and increased resistance against stress corrosion.

1. Material description

X2 CrNiMoSi 2 5-7-3
Material No. 1.4417
ASTM A 669
Vd TÜV-Data Sheet 1.79 385
Equivalent SANDVIC 3RE60

2. Supply form and condition

seamless tubes, annealed

3. Range of dimensions (Tubes)

Outside Diameter: . . . . .10-50 mm
Wall Thickness: . . . . .1-4 mm
Length: . . . . .max. 12.5 mm
(depending on diameter and wall)

4. Chemical composition
(nominal analysis in %)

C	Si	Mn	Cr	Ni	Mo
≤ 0.03	1.5-2.0	1.3-2.0	18.0-20.0	4.5-5.0	2.5-3.0

5. Mechanical properties
(minimum values)

0.2 proof stress at a temperature in °C N/mm²								tensile strength N/mm²	Elongation (A5) %
20	**100**	**150**	**200**	**250**	**285**	**300**	**325**		
min.500	370	350	330	325	320	315	310	700-900	≥ 30

6. Physical properties

Density	7.7 g/cm²	
Electrical resistance	0.25 Ohm mm²/m	
Thermal conductivity	at 20°C	20.9 W/m°C
at 300°C	25.5 W/m°C	
Linear coefficient of	at 20-100°C	11.2 10 6 m/m °C
expansion	at 20-200°C	13.0 10 6 m/m °C
at 20-300°C	13.6 10 6 m/m °C	
at 20-400°C	14.2 10 6 m/m °C	
Modulus of elasticity	at 20°C	198 10 3 m/m °C
at 250°C	174 10 3 m/m °C	
at 300°C	169 10 3 m/m °C	

7. Heat treatment

Quench annealing 950-1050°C/air or water

3. Range of dimensions (Tubes)

Outside Diameter:	10-114 mm
Wall Thickness:	1-12 mm
Length: (depending on diameter and wall)	max. 26.5 m

8. Welding

Weldability of Material No. 1.4417 is good. Due to the danger of carburizing, gas fusion welding should be avoided. For wall thickness from 0.8 mm up TIG-welding is recommended; from 1.5 mm up especially in case of fillet welds-arc welding with sheated bar electrodes is possible. After welding no heat treatment is required.

For the design of heat exchangers, tubes of Material No. 1.4417 are normally connected with tube sheets of fully austenitic steel or boiler construction steel. For these cases the following welding filler metals may be recommended:

a. to austenitic steel, e.g. (1.4571

Nominal analysis

20% Cr	67 % Ni	3 % Fe
19% Cr	10 % Ni	2.5 % Mo
19% Cr	11.5 % Ni	2.8 % Mo

b. to low-alloyed steel, e.g. boiler plate 17Mn4

Nominal analysis

24 % Cr	13 % Ni	
20 % Cr	67 % Ni	3 % Fe
18 % Cr	8 % Ni	6 % Mn

The welding filler metals mentioned under a. and b. have a C-content of max. 0.03% with the exception of alloy-type 18/8/6 having a C-content of approx 0.10%. If high stress of the welding joints has to be taken into account, welding filler metals of LC-quality should be used. In case of using Mo-free filler metal, the corrosion characteristics of the weld metal have to be taken into account.

9. Cold bending

Generally, in case of usual bending radii, post heating will not be required. In case of a higher degree of deformation at low temperatures (› 10%) annealing as indicated under 7. is necessary.

10. Hot bending

Hot bending should be performed in the temperature range from 1100-900°C. Afterwards, quench annealing as described under 7. will have to be carried out.

11. Corrosion behaviour

Due to its two-phase structure, Material No. 1.4417 has a higher resistivity against stress corrosion cracking than comparable fully austenitic CrNi-steels. Its use in media containing chloride, e.g. brackish water, is to be recommended, when austenitic steels have failed because of stress corrosion cracking. Its resistance against pitting is similar to that of X2CrNiMo 1812. In non-oxidizing solutions, e.g. formic acid and oxalic acid, a good continuity is noted.

12. Application

Due to its favourable physical-technological and corrosion-chemical characteristics, Material No. 1.4417 is preferably used in the following fields:

High pressure processes of the chemical industry
Due to its increased yield point there are advantages regarding wall thickness design.

13. Application

Application over long periods exceeding 325°C should be avoided. For pressure vessels according to AD-W2 the service temperature should range between-10°C up to + 285°C
(VdTÜV-Data Sheet)

Material No. 1.4465 is a fully austenitic Chromium-Nickel-Molybdenum steel with an extremely low Carbon content. The material is distinguished by very low corrosion rates at the Huey-test, and it is applied especially in those parts of Urea plants which are subjected to the most corrosive conditions.

1. Material description

X2CrNiMoN 25-25-2
Material No. (1.4465)

2. Supply form and condition

seamless tubes, pickled
(sheets, strips, rods, forgings)

3. Range of dimensions (Tubes)

Outside Diameter: . . . . .10-114 mm
Wall thickness: . . . . .1-12 mm
Length: . . . . .max. 26.5 m
(depending on diameter and wall)

4. Chemical composition
(nominal analysis in %)

C	Si	Mn	Cr	Ni	Mo	N
≤ 0.020	≤ 0.40	1.5-2.0	24.5-25.5	21.5-22.5	1.9-2.3	0.10-0.14

5. Mechanical properties

a) at room temperature

0,2% proof stress N/mm^2	Tensile strength N/mm^2	Elongation (A5)
min. 255	**min. 540**	**› 30**

b) at increased temperature
(minimum values)

Temperature °C	100	200	300	400	500
0,2-proof stress N/mm^2	230	210	185	160	140
1%-proof stress N/mm^2	270	240	220	195	170

6. Physical properties

Density	7,9 g/cm^2
Spec. electrical resistance	0,90 Ohm mm^2/m
Thermal conductivity	15 W/m °C

Temperature °C	20	100	200	300	400	500
Linerar coefficient (10 6 m/m °C) of expansion		15,0	15,7	16,0	16,6	16,8
Modulus of elasticity (10 3 N/mm^2)	200	195	180	178	170	164

7. Heat treatment

Quench annealing: 1050-1150 °C/water

Bright annealed: 1050-1150 ° C/gas

8. Welding

The weldability of Material No. 1.4465 can be described as good. For welding into tube sheets welding rods as well as the TIG welding process can be used.

As welding additives we recommend for the above processes S-NiCrFe27MoCu Material No. 1.4455, depending on application. Heat treatment (pre-or subsequent heating, resp) is generally not required.

As usual with austenitic Cr-Ni-steels, Material No. 1.4465 must also be welded with the least possible heat input.

9. Cold bending

There is generally no need for heat treatment after cold bending to usual bending radii. At a higher degree of deformation and operational conditions, which may suggest danger of stress corrosion cracking, heat treatment at 1050-1150 °C is recommended.

10. Hot bending

Hot bending should be carried out at a temperature range of 1150-850 °C. A quenching after hot forming can be advisable in some cases for maintaining the optimum corrosion performance. At rapid quenching from the hot forming temperature a subsequent annealing is generally not necessary.

11. Corrosion resistance

Material No. 1.4465 is distinguished from similar alloy steels not only by a better performance is respect of the corrosion rate, but also by higher resistance when subjected to pitting, stress corrosion cracking and inter-crystalline corrosion.

a. Intercrystalline corrosion

The excellent resistance to inter crystalline corrosion is proved by the Strauss-test

(SEP 1875-61 / DIN 50914) as well as the Huey-test (ASTM A 262, Practice C.)

b.Huey-test

Apart from the testing for resistance to grain disintegration the Huey-test also serves for investigating whether there are any further inhomogeneities such as precipitations within the grain, sigma phase and inclusions of Ferrite. For this reason the Huey-test represents a very strict testing method, which includes a great number of parameters.

Material No. 1.4465 has a max. corrosion rate of 1,5 µm/48h=

5,91 g/m^2 24h=0.27 mm/year at the Huey-test. This extraordinarily low value can only be guaranteed by special provisions at the production of the steel and by extensive quality control during the various of production.

c.Pitting corrosion

Due to the Molybdenum content and the increased Chromium content there is a good corrosion resistance to flowing waters containing Chlorides.

d.Stress corrosion cracking

Due to the increased Nickel content, Material No. 1.4465 has a considerably higher range of resistance to stress corrosion cracking than e.g. X2CrNiMo 1812 (TP 316 L)

e.Special environments

Material No. 1.4465 offers excellent corrosion resistance to a great number of corrosion environments. Especially worth noting here is the good performance in Nitric acid, Phosphoric acid and the Ammonium carbamate solution occurring in the Urea process.

12. Application

Urea plants

Material No. 1.4465 has been developed for the especially high requirements in strippers of Urea plants to the Stamicarbon process route.

This steel can also be successfully used, however, for other processes, where similar operational conditions exist as in the stripping process.

Nitric acid plants

Due to the very small corrosion rates at the Huey-test, Material No. 1.4465 is suitable for the application in Nitric acid plants and in equipment that is subjected to Nitric acid.

Other plants

Because of the increased corrosion performance as against comperable steels such as

X3CrNiMoN 2525, X2CrNiMo 1810 and X2CrNi 189 the application of Material No. 1.4465 should be also considered, if the former steels have failed to produce satisfactory results.

Characteristics:

Material No. 1.4466 and Mat. No. 1.4435 are austenitic, stainless and acid resisting nickel, chromium, molybdenum steels with a very low carbon content (ELC type).

Both grades have a fully austenitic structure. Material No. 1.4466 features improved strength due to its nitrogen addition, which is of particular importance for the 0,2% proof stress to be used as design basis. Material No. 1.4435 was mainly developed for urea plant applications.

Applications:

Material No. 1.4466 and Material No. 1.4435 are mainly used for parts and equipment in urea plant subjected to high pressures and temperatures, and to severe corrosion (steam separator, condenser, reactor, stripper, scrubber). Both grades are also suitable for applications involving the attack of a variety of chemicals in dyemills, in the textile, paper and leather industries, as well as the chemical, pharmaceutical and plastics industries.

The steels are not magnetic.

Corrosion resistance Intergranular corrosion

Owing to their alloying elements and to the melting technique employed.

Material No. 1.4466 and 1.4435 feature very good resistance to intergranular corrosion when tested according to DIN 50914. Their corrosion resistance is also found to be excellent when subjected to a Huey test according to ASTM A 252 Practice C – a maximum corrosion rate of 0.247 g/m_hr (1.4466) and 0.54 g/m_hr (1.4435) obtained as an average of 5 bolling periods of 48 hours each can be guaranteed.

Stress corrosion cracking and pitting

The alloying elements of Material No. 1.4466 give this grade improved resistance to stress corrosion cracking and pitting in high-chloride media (e.g. sea water) compared to that of conventional 18/8 steels.

Forming properties

Both grades can conveniently be cold formed, hot formed and machined.

Welding properties

Welding presents no difficulties. With an approved welding technique for fully austenitic filler metals sound weld joints can be achieved up to a plate thickness of 80 mm. Welding should be carried out with a short arc and mean amperage taking care to prevent weave beads exeeding two times the electrode diameter. Thick layers are to be avoided. It is recommended to chip out the end craters. Interpass temperature should not exceed 150°. Quite on general, no postheat-treatment is required.

Material Data 1.4435

X 2 CrNiMo 18-14-3
W. No. 1.4435
AISI TYPE 316 L
Stamicarbon nv: Spez. 18005 Section I Material

Chemical composition in wt.%

C	Si	Mn	P	S	Cr	Mo	Ni
max.0,020	0,50	1,70	max.0,015	max.0,010	17,5	2,5	14,5

Mechanical properties at 20°C

0,2% proof stress N/mm2 min.	1% proof stress N/mm2 min.	tensile strength N/mm2	elongation after fracture (Lo=5do)
195	235	450-700	40

Mechanical properties at elevated temperatures in N/mm²

Temperature °C	100	150	200	250	300	350	400	450	500
0,2% proof stress	165	150	137	127	119	113	108	103	100
1% proof stress	200	180	165	153	145	139	135	130	128

Physical properties

Specific gravity at 20°C 7,95 g/cm2
Thermal conductivity at 20°C ......15 W/mK
Specific heat at 20°C ....500 J/kgK
Modulus of elasticity at 20°C 200000 N/mm2

Thermal expansion in 10^{-6} m/m °C ....20 to 100°C 16,5
.................................20 to 200°C 17,5
.................................20 to 300°C 17,5
.................................20 to 400°C 18,5
.................................20 to 500°C 18,5

Material Data 1.4466

X 1 CrNiMoN 25-25-2

W.Nr. 1.4466

Stamicarbon nv: Spez: 53930-X 2 CrNiMo 25 22 2*

Chemical composition in wt.%

C	Si	Mn	P	S	Cr	Mo	Ni	N
max. 0.020	max. 0.40	1,7	max. 0.015	max. 0.015	25	2,15	22	0,12

Size range

*) Approval already abtained

Mechanical properties at 20°C

0.2% proof stress N/mm2 min.	1% proof stress N/mm2 min.	tensile strength N/mm2	elongation after fracture (Lo=5do) % min.
255	295	540-740	35

Mechanical properties at elevated temperature in N/mm2

Temperature °C	100	150	200	250	300	350	400
0.2% proof stress	226	216	206	191	177	167	162
1% proof stress	255	235	226	216	206	196	182

Physical properties

Specific gravity at 20°C 7.95 g/cm2
Thermal conductivity at 20°C 15W/mk
Specific heat at 20°C ....500 J/kg K
Modulus of elasticity at 20°C 200000 N/mm2

Thermal expansion in 10 6 m/m °C ...
20 to 100°C 16.5
20 to 200°C 17,5
20 to 300°C 18.5
20 to 400°C 18.5

Lenghts available, finish and size range

The seamless tubes are supplied cold finished and hot finished.
The standard finish is in accordance with ASTM A 213, ASTM A 312 and DIN 2462 or DIN 2464.

Abbreviations according to DIN 17440
C2 ....hot finished, heat treated, pickled
h ....descaled, cold finished, heat treated, pickled
m ....descaled, cold finished, bright annealed

Tubes are supplied in random lenghts, restricted lengths, multiple lengths, approximate lengths, fixed lengths and bent as U-tubes. The greatest lengths available are 30 m and differ according to grade, size and finish. Detailed information can be given upon request.

MATERIAL NUMBER 1.4713 – X 10 CRAL7

Composition in %:

C	Si	Mn	P	S	Cr	Mo	Ni
Max.0,12	0,50-1,00	max.1,00	max.0,040	max.0,030	6,00-8,00		
V	**W**	**Ti**	**Cu**	**Al**	**Nb**	**B**	**N**
				0,50-1,00			

Range of application and heat treatment:

Stainless Steel: beams and pipes in the furnace making, mains cable and widing components

soft annealing: 780-840°C

MATERIAL NUMBER 1.4724 – X10 CRAL 13

Composition in %:

C	Si	Mn	P	S	Cr	Mo	Ni
max.0,12	0,70-1,40	max.1,00	max.0,040	max.0,030	12,00-14,00		
V	**W**	**Ti**	**Cu**	**Al**	**Nb**	**B**	**N**
				0,70-1,20			

Range of application and heat treatment:

Stainless steel: stove-and boiler engineering, mains cable and widing ropes

Soft annealing: 800-860°C

MATERIAL NUMBER 1.4762 – X 10 CRAL 24

Composition in %:

C	Si	Mn	P	S	Cr	Mo	Ni
Max.0,12	0,70-1,40	max.1,00	max.0,040	max.0,030	23,00-26,00		
V	**W**	**Ti**	**Cu**	**Al**	**Nb**	**B**	**N**
				1,20-1,70			

Range of application and heat treatment:

Heat resisting steel: components for high temperatures at lower mechanical load, convector

Soft annealing: 800-860°

MATERIAL NUMBER 1.4742 – X 10 CRAL 18

C	Si	Mn	P	S	Cr	Mo	Ni
max.0,12	0,70-1,40	max.1,00	max.0,040	max.0,030	17,00-19,00		
V	**W**	**Ti**	**Cu**	**Al**	**Nb**	**B**	**N**
				0,70-1,20			

Composition in %:

Range of application and heat treatment:

Heat resisting steel: stove accessories, annealing tubes, annealing pots

Soft annealing: 800-860°C

MATERIAL NUMBER 1.4828 – X 15 CRNISI 20-12

C	Si	Mn	P	S	Cr	Mo	Ni
Max.0,20	1,50-2,50	max.2,00	max.0,045	max.0,030	19,00-21,00		11,00-13,00
V	**W**	**Ti**	**Cu**	**Al**	**Nb**	**B**	**N**

Composition in %:

Range of application and heat treatment:

Heat resisting steel: stove-and apparatus construction, beams, plates, annealing bells

Solution annealing: 1050-1150°C

MATERIAL NUMBER 1.4841 – X 15 CRNISI 25-20

C	Si	Mn	P	S	Cr	Mo	Ni
max.0,20	1,50-2,50	max.2,00	max.0,045	max.0,030	24,00-26,00		19,00-22,00
V	**W**	**Ti**	**Cu**	**Al**	**Nb**	**B**	**N**

Composition in %:

Range of application and heat treatment:

Heat resisting steel: heating conductor, burning baskets, suspensions

Solution annealing: 1050-1150 °C

Properties, applications and processing

1.4713 is the standard grade of heat resisting steel used in furnance building and construction.

High temperature corrosion resistance

1.4713 is resistant to oxidising sulphur bearing gases and is also resistant to carburisation. This grade of steel is resistant to scaling in air up to temperatures of 800°C. Only limited resistance to nitrogen containing and oxygen denuded gasses is to be expected.

Heat treatment / mechanical properties

Optimal material properties are realised after solution annealing by holding in the temperature range 780-840°C, followed by rapid cooling in air or water. In this condition the following mechanical properties can be expected:

Property	Specification	Typical
yield strength (N/mm2)	Rp0,2: ≥250	310
tensile strength (N/mm2)	Rm: 450-600	490
hardness	HB: ≤200	

Welding

1.4713 is weldable using all usual welding processes with preheating to a temperature between 200 and 300°C, being recommended. Low heat inputs should be used when welding to reduce any possible grain coarsening. Although post weld heat treatment is not necessary, a stress relief treatment is sometime performed in the temperature range 650 to 750°C.

1.4502 and 1.4551 are suitable for use as filler materials when welding 1.4713.

Forging

Forging is usually performed at 800-1150°C followed by rapid cooling in air or water. Generally, forging is followed by the heat treatment described previously. Post forging heat treatment may not be necessary if the temperature of the final forging pass is above 900°C and the forged components are then allowed to cool slowly in a closed box.

Machining properties

Ferritic stainless steels such as 1.4713 tend to smear during machining which results in the formation of longer swarf which makes machining difficult and creates extreme difficulty during automated machining. When machining this grade of steel with coated hard metal cutting / machining tools, the following machining parameters can be used as a guideline:

		depth of cut (mm) feed (mm/rev)	
tensile strengths Rm in N/mm^2	6 mm 0,5 mm/r	3 mm 0,4 mm/r	1 mm 0,2 mm/r
solution annealed (450-550)	160 m/min	190 m/min	260 m/min

1.4724 is resistant to oxidising sulphur bearing gases and displays somewhat less, but still good, resistance to sulphur bearing gasses in reducing environments. 1.4724 displays poor resistance to carburising gasses, and is also not resistant to high temperature nitriding, oxygen denuded gasses. This grade of steel is resistant to scaling in air up to temperatures of 850°C.

Heat treatment / mechancial properties

Optimal material properties are realised after annealing by holding in the temperature range 800-860°C, followed by rapid cooling in air or water. In this condition the following mechanical properties can be expected when testing in the longitudinal direction at room temperature:

Property	Specification	Typical
yield strength (N/mm2)	Rp0,2: ≥250	360
tensile strength (N/mm2)	Rm: 450-650	510
tensile elongation (%)	A5: ≥15	18
hardness	HB: ≤192	

A slight tendency for grain growth and embrittlement exists at above temperatures of 950°C. It must be noted that any properties that are adversely affected by grain coarsening occurs cannot be recovered by simple thermal treatments.

The moderate chromium content and fully ferritic microstructure of this steel makes it susceptible to 475 embrittlement when held at temperatures within the range

400 to 550°C. Slow heating or cooling through this temperature range should thus be avoided. The effects of 475 embrittlement can be reversed by briefly heating to within the temperature range 700 to 800°C. This steel is also susceptible to embrittlement by sigma phase formation within the temperature range 600 to 800°C over long periods of time. The effects of sigma phase formation may be reversed by heating to above 1050°C to take all of the sigma phase into solution again.

When heat treatment is performed in a continuos furnace, the upper temperature must be aimed for and in some cases can even be exceeded.

Welding

1.4724 is weldable using all usual welding processes with preheating to a temperature between 200 and 300°C, being recommended. Low heat inputs should be used when welding to reduce any possible grain coarsening effects. Although post weld heat treatment is not necessary, a stress relief treatment is sometimes performed in the temperature range 750 to 800°C, followed by air cooling, when large differences in cross-section exist and/or when the components have been extensively cold worked.

1.4723, 1.4820 and 1.4829 are all suitable for use as filler material when welding 1.4724.

Elevated temperature properties

Due to the much poorer high temperature mechanical properties of 1.4724 compared to the heat resistant austenitic grades, this steel can be used in applications where the high temperature mechanical requirements are not too great.

Forging

Forging is usually performed at 1150-800°C followed by rapid cooling in air or water. Generally, forging is followed by the heat treatment described previously.

Machining properties

Ferritic stainless steels such as 1.4724 tend to smear during machining which results in the formation of longer swarf thereby making machining difficult. When machining this grade of steel with coated hard metal cutting/machining tools, the following machining parameters can be used as a guideline:

	depth of cut (mm) feed (mm/rev)		
tensile strengths Rm in N/mm^2	6 mm 0,5 mm/r	3 mm 0,4 mm/r	1 mm 0,2 mm/r
solution annealed (450-550)	140 m/min	170 m/min	240 m/min

High temperature corrosion resistance

1.4742 is highly resistant to oxidising sulphur bearing gases and displays somewhat less, but still good, resistance to sulphur bearing gasses in reducing environments. 1.4742 is moderately resistant to carburising gasses, but is not resistant to high temperature nitriding or oxygen denuded gasses. This grade of steel is resistant to scaling in air up to temperatures of 1000°C.

Heat treatment / mechanical properties

Optimal material properties are realised after annealing by holding in the temperature range 800 – 860°C *, followed by rapid cooling in air or water. In this condition the following mechanical properties can be expected when testing in the longitudinal direction at room temperature:

Property	Specification	Typical
yield strength (N/mm2)	Rp0,2: ≥ 270	370
tensile strength (N/mm2)	Rm: 500 – 700	580
tensile elongation (%)	A5: ≥15	18
hardness	HB: ≤ 212	

The high chromium content and fully ferritic microstructure of this steel makes it susceptible to 475 embrittlement when held at temperatures within the range 400 to 550°C. Slow heating or cooling through this temperature range should thus be avoided. The effects of 475 embrittlement can be reversed by briefly heating to within the temperature range 700 to 800 °C. Due to the high chromium content of this steel, it is susceptible to embrittlement by sigma phase formation within the temperature range 600 to 800°C. The effects of sigma phase formation may be reversed by heating to above 1050°C to take all of the sigma phase into solution again.

A slight tendency for grain growth and embrittlement exists at above temperatures of 950°C. It must be noted that any properties that are adversely affected by grain coarsening occurs cannot be recovered by simple thermal treatments.

* When heat treatment is performed in a continuos furnace, the upper temperature must be aimed for and in some cases can even be exceeded.

Welding

1.4742 is weldable using all usual welding processes with preheating to a temperature between 200 and 300°C, being recommended. Low heat inputs should be used when welding to reduce any possible grain coarsening. Although post weld heat treatment is not necessary, a stress relief treatment is sometimes performed in the temperature range 650 to 800°C when large differences in cross-section exist and/or when the components have been extensively cold worked.

If an austenitic filler metal is used and the component is destined for use in either a sulphur containing or carburising environment, then the austenitic weld bead must be over-laid with a ferritic weld run to ensure some resistance to the operational environment.

1.4820 is suitable for use as a filler material when welding 1.4742.

Elevated temperature properties

Due to the much poorer high temperature mechanical properties of 1.4742, compared to the heat resistant austenitic grades, this steel can only be used in applications where the high temperature mechanical requirements are not too great.

Forging

Forging is usually performed at 1150 – 800°C followed by rapid cooling in air or water. Generally, forging is followed by the heat treatment described previously.

Machining properties

Ferritic stainless steels such as 1.4742 tend to smear during machining which results in the formation of longer swarf thereby making machining difficult. When machining this grade of steel with coated hard metal cutting/machining tools, the following machining parameters can be used as a guideline:

depth of cut (mm) feed (mm/rev)			
tensile strengths Rm in N/mm^2	6 mm 0.5 mm/r	3 mm 0.4 mm/r	1 mm 0.2 mm/r
solution annealed (550 – 650)	100 m/min	130 m/min	150 m/min

General comments

1.4742 is less formable than the austenitic grades and is best formed within the temperature range 600 to 800°C, especially when the cross section is greater than 3 mm.

1.4828 is a standard steel grade used for the fabrication of furnace furniture and other high temperature components. Compared with 1.4878 and 1.4713, 4828 exhibits superior resistance to scaling. Due to its high tensile strength at elevated temperatures, compared with other grades, 4828 is ideally suited for applications where a greater emphasis is placed on mechanical property requirements.

High temperature corrosion resistance

1.4828 has a low resistance to oxidising and reducing sulphur bearing gases. In these gasses, the use of 1.4828 is generally limited to temperatures below 650°C. The resistance to carburising (up to 900°C) and to nitrogen bearing, oxygen depleted gases is average.

Property	Specification	Typical
- yield strength (N/mm2)	Rp0,2: ≥ 230	400
- tensile strength (N/mm2)	Rm: 550 – 750	675
- tensile elongation (%)	A5: ≥ 30	45
- hardness	HB: ≤ 223	

Heat treatment/mechanical properties

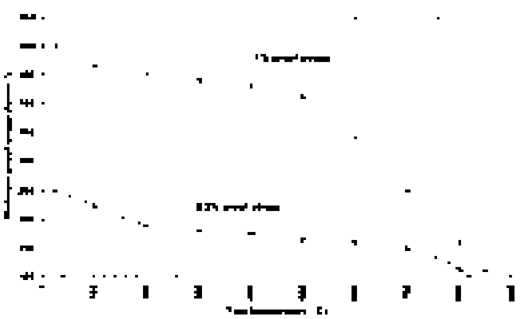
Optimal material properties are realised after solution annealing in the temperature range 1050 – 1150°C followed by rapid cooling in air or water. During operation and fabrication, the time spent in the temperature range 550 – 900°C must be minimised to avoid embrittlement, resulting from both chromium carbide precipitation and sigma phase formation. This embrittlement effect can be reversed by solution annealing the steel at a temperature in the range 1050 to 1100°C.
In the solution annealed condition the following mechanical properties may be attained when testing in the longitudinal direction at room temperature.

Welding

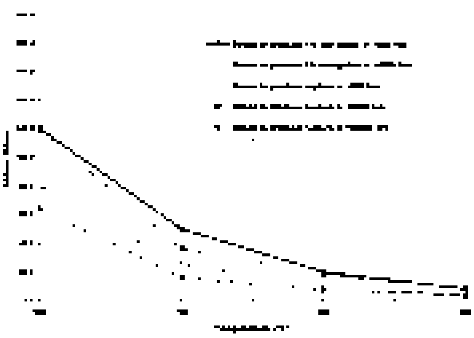
4828 is weldable using all usual welding processes with no preheating being required. Low heat inputs should be used when welding, and post weld heat treatment is not necessary. 1.4829 and 4842 are suitable for use as filler materials when welding 4828.
Forging is usually performed at 1150 – 800°C followed by rapid cooling in air or water.

Elevated temperature properties

The following minimum tensile properties at various temperatures are what can be typically expected of this grade of steel.



The temperature-stress-time relationships that are important for 1.4828 from a creep point of view are presented in the graph below:



Machining properties:

The formation of carbides in 1.4828 will result in increased wear of cutting tools. In addition to this, rapid work hardening and poor thermal conductivity require the use of adequate cooling and good quality cutting/machining tools. It is thus recommended that machining is performed in the solution annealed condition using coated hard metal cutting/machining tools and the following machining parameters as a guideline.

	depth of cut (mm) feed (mm/rev)		
tensile strengths Rm in N/mm^2	6 mm 0.5 mm/r	3 mm 0.4 mm/r	1 mm 0.2 mm/r
solution annealed (550 – 625)	100 m/min	130 m/min	150 m/min

Group	DIN code	DIN material no.	EN code	EN material no.
Copper	OF-Cu	2.0040	Cu-OF	CW008A
	SE-Cu	2.0070	Cu-PHC/Cu-HPC	CW020A/021A
	SF-Cu	2.0090	Cu-DHP	CW024A
	E-Cu 58	2.0060	Cu-ETP/FRHC	CW004A/005A
Low Alloy Copper	CuCrZr	2.1293	CuCr1Zr	CW106C
Copper-Zinc Alloy	CuZn5	2.0220	CuZn5	CW500L
	CuZn10	2.0230	CuZn10	CW501L
	CuZn15	2.0240	CuZn15	CW502L
	CuZn20	2.0250	CuZn20	CW503L
	CuZn28	2.0260	CuZn28	CW504L
	CuZn30/33	2.0265/2.0280	CuZn30/33	CW505/506L
	CuZn36	2.0335	CuZn36	CW507L
	CuZn37	2.0321	CuZn37	CW508L
	CuZn40	2.0360	CuZn40	CW509L
	CuZn37Pb0.5	2.0332	CuZn37Pb0.5	CW604N
	CuZn36Pb1.5	2.0331	CuZn35Pb1	CW600N
	CuZn38Pb1.5	2.0371	CuZn38Pb1	CW607N
	CuZn39Pb0.5	2.0372	CuZn39Pb0.5	CW610N
	CuZn36Pb3	2.0375	CuZn36Pb3	CW603N
	CuZn39Pb2	2.0380	CuZn39Pb2	CW612N
	CuZn40Pb2	2.0402	CuZn40Pb2	CW617N
	CuZn39Pb3	2.0401	CuZn39Pb3	CW614N
	n.V.		CuZn36Pb2As	CW602N
	CuZn44Pb2	2.0410	CuZn43Pb2	CW623N
	CuZn28Sn1	2.0470	CuZn28Sn1As	CW706R
	CuZn31Si1	2.0490	CuZn31Si1	CW708R
	CuZn35Ni2	2.0540	CuZn35Ni3Mn2AlPb	CW710R
	CuZn37Al1	2.0510	CuZn38Mn1Al	CW716R
	CuZn40Mn2	2.0572	CuZn40Mn2Fe1	CW723R
	CuZn40Al2	2.0550	CuZn37Mn3Al2SiPb	CW713R
	CuZn20Al2	2.0460	CuZn20Al2As	CW720R
Copper-Tin Alloy	CuSn4	2.1016	CuSn4	CW450K
	CuSn6	2.1020	CuSn6	CW452K
	CuSn8	2.1030	CuSn8	CW453K
	CuSn6Zn6	2.1080	n.V.	n.V.
Copper-Nickel Zinc-Alloy	CuNi12Zn24	2.0730	CuNi12Zn24	CW403J
	CuNi18Zn27	2.0742	CuNi18Zn27	CW410J
	CuNi18Zn20	2.0740	CuNi18Zn20	CW409J
	CuNi7Zn39Mn5Pb3	2.0771	n.V.	n.V.
	CuNi12Zn30Pb1	2.0780	CuNi12Zn30Pb1	CW406J
	CuNi18Zn19Pb1	2.0790	CuNi18Zn19Pb1	CW408J
Copper-Nickel Alloy	CuNi10Fe1Mn	2.0872	CuNi10Fe1Mn	CW325H
	CuNi30Mn1Fe	2.0882	CuNi30Mn1Fe	CW354H
	CuNi9Sn2	2.0875	CuNi9Sn2	CW351H
Continuous Cast	GC-CuSn7ZnPb	2.1090	CuSn7Zn4Pb7-C-GC	CC 493K
	GC-CuSn12	2.1052	CuSn12-C-GC	CC 483K
	GC-CuPb10Sn	2.1176	CuSn10Pb10-C-GC	CC 495K
	GC-CuPb15Sn	2.1182	CuSn7Pb15-C-GC	CC 496K
	GC-CuSn12Pb	2.1061	CuSn11Pb2-C-GC	CC 482K
	GC-CuSn12Ni	2.1060	CuSn12Ni2-C-GC	CC 484K

Codes: Germany	US	GB	France	International
DIN 1787	ASTM B 224	BS 6017	NF A 51-050 NF A51-108	ISO 431-1981 ISO 1337-1980
E-Cu 57	C11000/ETP	C 101/Cu-ETP-2	Cu al	Cu-EPT
E-Cu 58	C 10300/OXXLP	C 102/Cu OF	Cu-pl	Cu-HCP
SE-Cu	C 012200/DHP	C 106/Cu-DHP	Cu-bl	
SF-Cu	C 12000/DLP		Cu-b2	
CuZn5	B36,134,587,642 C21000	2870/2875 CZ125	A51-101/103 CuZn5	CuZn5
Cu Zn 10	B 36130,131,134 135,587 C 22000	CZ 101	CuZn10	Cu Zn 10
Cu Zn 15	B36,43,111,135, 359, 587 C23000	CZ 102	CuZn15	Cu Zn 15
Cu Zn 20	B 36,134C 24000	CZ 103	Cu Zn20	Cu Zn 20
Cu Zn 28				
Cu Zn 30	B 19 36,134,135, 569, 587 C 26000	CZ 106	Cu Zn 30	Cu Zn 30
Cu Zn 33	B 36, 587 C 26800	CZ 107	Cu Zn 33	Cu Zn 33
Cu Zn 36	B 36 134,135,587 C 27000		Cu Zn 36	
Cu Zn 37	B36, 134,135,587 C 27400 C 27200	CZ 108		Cu Zn 37
Cu Zn 40	B111,135 C28000	CZ 109	Cu Zn40	Cu Zn 40
Cu Zn 36 Pb 1.5	B 453 C34500,C34700	CZ 119 CZ 118	Cz Zn 35 Pb2	Cu Zn 35 Pb2 Cu Zn 36 Pb 1
Cu Zn 37 Pb 0.5	C 34900, C 34800			
Cu Zn 36 Pb 3	B 16,121,453 C 36000,C 35600	CZ 124	Cu Zn 36 Pb 3	Cu Zn 36 Pb 3
Cu Zn 38 Pb 1.5	B 135 C 35300 C37000	CZ 128	Cu Zn 38 Pb2	Cu Zn 38 Pb 2
Cu Zn 39 Pb 0.5	B 171 C 36500	CZ 123		Cu Zn 40 Pb
Cu Zn 39 Pb 2	B 124, 283 C37700	CZ 120	Cu Zn 39 Pb2	Cu Zn 39 Pb 2
Cu Zn 39 Pb 3	B455 C 38500	CZ 121	Cu Zn 40 Pb3	Cu Zn 40 Pb 3
Cz Zn 40 Pb 2	B455 C 38000	CZ 122	Cu Zn 39 Pb 2	Cu Zn 39 Pb 2
Cu Zn 44 Pb 2		CZ 130		Cu Zn 43 Pb 2
Cu Zn 20 Al	B 111, 359,395 C68700	CZ 110	Cu Zn 22 Al 2	Cu Zn 22 Al 2
Cu Zn 28 Sn	B111,171,359,395,543C 44300	CZ 111	Cu Zn 29 Sn 1	Cu Zn 28 Sn 1
Cu Zn 31 Si	C 69800			
Cu Zn35 Ni				
Cu Zn 39 Sn	B 21,124,171,283 C46400	CZ112,113		Cu Zn 38 Sn 1
Cu Zn 40 Al 1		CZ 114		Cu Zn 39 Al FeMn
Cu Zn 40 Al 2	C 67400	CZ 114		
Cu Zn 40 Ni				
Cu Zn 40 Mn				
Cu Zn 40 MnPb		CZ 115		
Cu Sn 4	B 100,103 C51100	PB 101	Cu Sn 4 P	Cu Sn 4
Cu Sn 6	C 51900	PB 103	Cu Sn 6 P	Cu Sn 6
Cu Sn 8	B 103,139,159 C52100	PB 104	Cu Sn 8 P	Cu Sn 8
Cu Sn 6 Zn 6				

European EN 573	Germany DIN	Great Britain BS	France	Italy UNI		USA ASTM	Japan JIS	AA
				Hold	New			
EN AW-1080A (Al 99.8 (A))	Al99.8	1080A	1080A	4509	9001/4	A1080	A1080	1080A
EN AW-1070A (Al 99.7)	Al99.7		1070A	4508	9001/3	1070A	A1070	1070A
EN AW-1050A (Al 99.5)	Al99.5	1050A	1050A	4507	9001/2	1050A	A1050	1050A
EN AW-1200 (Al 99.0)	Al99	1200	1200	3567	9001/1	1200	A1200	1200
EN AW-1100 (Al 99.0Cu)			1100			1100	A1100	1100
EN AW-2011 (Al Cu6BiPb)	Al Cu6BiPb	2011	2011	6362	9002/5	2011	A2011	2011
EN AW-2014 (Al Cu4SiMg)	AlCuSiMn	2014A	2014	3581	9002/3	2014	A2014	2014
EN AW-2017A (Al Cu4MgSi(A))	AlCuMg1	2017A	2017A	3579	9002/2	2017A	A2017	2017
EN AW-2618A (Al Cu2Mg1.5Ni)		2618A	2618A	7250		2618A		2618A
EN AW-2024 (Al Cu4Mg1)	AlCuMg2	2024	2024	3583	9002/4	2024	A2024	2024
EN AW-2030 (Al Cu4PbMg)	AlCuMgPb		2030			2030		2030
EN AW-3003 (Al Mn Cu)	AlMnCu	3103	3003	7788	9003/1	3003	A3003	3003
EN AW-3004 (Al Mn1 Mg1)	AlMn1Mg1		3004	6361	9003/2	3004	A3004	3004
EN AW-3005 (Al Mn1Mg0.5)	AlMn1Mg0.5		3005		9003/4	3005	A3005	3005
EN AW-3105 (Al Mn0.5Mg0.5)	AlMn0.5Mg0.5	3105	3105	3103				
EN AW-5005 (Al Mg1(B))	AlMg1	5005	5005	5764	9005/1	5005	A5005	5005
EN AW-5049 (Al Mg2.5Mn0.8)	AlMg2Mn0.8		5049			5049		5049

European EN 573	Germany DIN	Great Britain BS	France	Italy UNI		USA ASTM	Japan JIS	AA
				Hold	New			
EN AW-5251 (Al Mg2)	AlMg2Mn0.3	5251	5251	4511	5251		5251	
EN AW-5052 (Al Mg2.5)	AlMg2.5		5052	3574	9005/2	5052	A5052	5052
EN AW-5454 (Al Mg3Mn)	AlMg2.7Mn	5454	5454	7789	9005/3	5454	A5454	5454
EN AW-5754 (Al Mg3)	AlMg3		5754			5754		5754
EN AW-5356 (Al Mg5Cr(A))	AlMg5	3576	5356			5356		
EN AW-5182 (Al Mg4.5Mn0.4)	AlMg5Mn		5182			5182		5182
EN AW-5083	AlMg4.5Mn	5083	5083	7790	9004/5	5083	A5083	5083
EN AW-5086 (Al Mg4)	AlMg4Mn		5086	5452	9005/4	5086	A5086	5086
EN AW-6005A (Al MgSi(A))	AlMgSi0.7		6005A		9006/6	6005A		6005A
EN AW-6060 (Al Mg Si)	AlMgSi0.5	6063	6060	3569	9006/1	6060		6060
EN AW-6061 (Al Mg1SiCu)	AlMg1SiCu	6061	6061	6170	9006/2	6061	A6061	6061
EN AW-6082 (Al Si MgMn)	AlMgSi1	6082	6082	3571	9006/4	6082		6082
EN AW-7020 (AlZn4.5Mg1)	AlZn4.5Mg1	7020	7020	7791	9009/1	7020	7020	
EN AW-7049A (Al Zn)			7049A			7049A		
EN AW-7075 (Al Zn5.5MgCu)	AlZnMgCu1.5	7075	7075	3735	9007/2	7075	A7075	7075
EN AW-8011 (Al FeSi)			8011		8011			8011

Equivalence only. Composition not always identical for each standard.

Alloy

Earlier Temper	1050 A Al99.5	3103 AlMn1	5052 AlMg2.5	5754 AlMg3	5083 AlMg4.5Mn
W7	0/H111	—	—	—	—
F8	H112	—	—	—	—
W9	—	0/H111	—	—	—
F9	H12	—	—	—	—
G9	H22	—	—	—	—
G11	H24	—	—	—	—
F11	H14	—	—	—	—
F12	—	H12	—	—	—
G13	H26	—	—	—	—
F13	H16	—	—	—	—
F14	—	H14	—	—	—
F15	H19	—	—	—	—
W17	—	—	0/H111	—	—
F17	—	H16	—	—	—
W19	—	—	—	0/H111	—
F19	—	—	—	H112	—
F20	—	—	—	H112	—
F21	—	H18	H12	H112	—
G21	—	—	H22	—	—
F22	—	—	—	H12	—
G22	—	—	—	H22	—
F23	—	—	H14	—	—
G23	—	—	H24	—	—
F24	—	—	—	H14	—
G24	—	—	—	H24	—
F25	—	—	H16	—	—
G25	—	—	H26	—	—
F27	—	—	H18	H16	—
G27	—	—	H28	H26	—
W28	—	—	—	—	0/H111
F28	—	—	—	—	H112
F29	—	—	—	H18	—
G31	—	—	—	—	H22
G35	—	—	—	—	H24

Chemical Composition

Element	Composition %								
	Grade 1	Grade 3	Grade 4	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11
Carbon, max.	0.30	0.19	0.12	0.30	0.19	0.13	0.20	0.20	0.10
Manganese	0.40-1.06	0.31-0.64	0.50-1.05	0.29-1.06	0.90 max	0.90 max	0.40-1.06	1.15-1.50	0.60 max
Phosphorus, max	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.035	0.025
Sulfur, max	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.015	0.025
Silicon	-	0.18-0.37	0.08-0.37	0.10 min	0.13-0.32	0.13-0.32	-	0.10-0.35	0.35 max
Nickel	-	3.18-3.82	0.47-0.98	-	2.03-2.57	8.40-9.60	1.60-2.24	0.25 max	35.0-37.0
Chromium	-	-	0.44-1.01	-	-	-	-	0.15 max	0.50 max
Copper	-	-	0.40-0.75	-	-	-	0.75-1.25	0.15 max	-
Aluminium	-	-	0.04-0.30	-	-	-	-	0.06 max	-
Vanadium, max	-	-	-	-	-	-	-	0.12	-
Columbium, max	-	-	-	-	-	-	-	0.05	-
Molybdenum, max	-	-	-	-	-	-	-	0.05	0.50 max
Cobalt	-	-	-	-	-	-	-	-	0.50 max

Tensile Requirement

	Grade 1		Grade 3		Grade 4		Grade 6		Grade 7		Grade 8		Grade 9		Grade 10		Grade 11	
	psi	MPa	psi	MPa	psi	MPa	psi	MPa	psi	MPa	psi	MPa	psi	MPa	psi	MPa	psi	Mpa
Tensile strength, min	55 000	380	65 000	450	60 000	415	60 000	415	65 000	450	100 000	690	63 000	435	80 000	550	65 000	450
Yield strength, min	30 000	205	35 000	240	35 000	240	35 000	240	35 000	240	75 000	515	46 000	315	65 000	450	35 000	240
	Longi-tudinal	Trans-verse	Longi-tudinal	Trans-verse	Longi-tudinal	Trans-verse	Longi-tudinal	Trans-verse	Longi-tudinal	Trans-verse	Longi-tudinal	Trans-verse	Longi-tudinal	Trans-verse	Longi-tudinal	Trans-verse	Longi-tudinal	
Elongation in 2 in. or 50 mm, (or 4D), min. % Basic minimum elongation for walls 5/16 in. (8mm) and over in thickness, strip tests, and for all small sizes tested in full section	35	25	30	20	30	16.5	30	16.5	30	22	22	-	28	-	22	-	18A	
When standard round 2-in. or 50-mm gage-length or proportion-ally smaller size test specimen with the gage length equal to 4D (4 times the dia-meter) is used	28	20	22	14	22	12	22	12	22	14	16	-	-	-	16	-	-	
For strip tests, a de-duction for each 1/32 in. (0.8 mm) decrease in wall thickness below 5/16 in. (8 mm) from the basic mini-mum elongation of the following percentage	1.75	1.25	1.50	1.00	1.50	1.00	1.50	1.00	1.50	1.00	1.25	-	1.50	-	1.25	-	-	

Tensile Requirements (continued)

Wall Thickness		Elongation in 2 in. or 50 mm, min, %C															
		Grade 1		Grade 3		Grade 4		Grade 6		Grade 7		Grade 8		Grade 9		Grade 10	
in	mm	Longi-tudinal	Trans-verse	Longi-tudinal	Trans-verse	Longi-tudinal	Trans-verse	Longi-tudinal	Trans-verse	Longi-tudinal	Trans-verse	Longi-tudinal	Trans-verse	Longi-tudinal	Trans-verse	Longi-tudinal	Trans-verse
5/16 (0.312)	8	35	25	30	20	30	16	30	16	30	22	22	-	28	-	22	-
9/32 (0.281)	7.2	33	24	28	19	28	15	28	15	28	21	21	-	26	-	21	-
1/4 (0.250)	6.4	32	23	27	18	27	15	27	15	27	20	20	-	25	-	20	-
7/32 (0.219)	5.6	30	-	26	-	26	-	26	-	26	-	18	-	24	-	18	-
3/16 (0.188)	4.8	28	-	24	-	24	-	24	-	24	-	17	-	22	-	17	-
5/32 (0.156)	4	26	-	22	-	22	-	22	-	22	-	16	-	20	-	16	-
1/8 (0.125)	3.2	25	-	21	-	21	-	21	-	21	-	15	-	19	-	15	-
3/32 (0.094)	2.4	23	-	20	-	20	-	20	-	20	-	13	-	18	-	13	-
1/16 (0.062)	1.6	21	-	18	-	18	-	18	-	18	-	12	-	16	-	12	

Grade	Direction of Test	Equation
1	Longitudinal	E = 56t + 17.50 (E = 2.19t + 17.50)
	Transverse	E = 40t + 12.50 (E = 1.56t + 12.50)
3	Longitudinal	E = 48t + 15.00 (E = 1.87t + 15.00)
	Transverse	E = 32t + 10.00 (E = 1.25t + 10.00)
4	Longitudinal	E = 48t + 15.00 (E = 1.87t + 15.00)
	Transverse	E = 32t + 6.50 (E = 1.25t + 6.50)
6	Longitudinal	E = 48t + 15.00 (E = 1.87t + 15.00)
	Transverse	E = 32t + 6.50 (E = 1.25t + 6.50)
7	Longitudinal	E = 48t + 15.00 (E = 1.87t + 15.00)
	Transverse	E = 32t + 11.00 (E = 1.25t + 11.00)
8 and 10	Longitudinal	E = 40t + 9.50 (E = 1.56t + 9.50)
9	Longitudinal	E = 48t + 13.00 (E = 1.87t + 13.00)

Where

E = elongation in 2 in. or 50 mm, in %, and

t = actual thickness of specimen, in . (mm)

Chemical Composition

Grade	UNS Designation	Composition, %							
		Carbon	Manganese max.	Phosphorus	Sulfur max	Silicon	Chromium	Molybdenum	Others
P1	K11522	0.10-0.20	0.30-0.80	0.025	0.025	0.10-0.50	—	0.44-0.65	—
P2	K11547	0.10-0.20	0.30-0.61	0.025	0.025	0.10-0.30	0.50-0.81	0.44-0.65	—
P5	K41545	0.15 max	0.30-0.60	0.025	0.025	0.50 max	4.00-6.00	0.45-0.65	—
P5b	K51545	0.15 max	0.30-0.60	0.025	0.025	1.00-2.00	4.00-6.00	0.45-0.65	—
P5c	K41245	0.12 max	0.30-0.60	0.025	0.025	0.50 max	4.00-6.00	0.45-0.65	—
P9	S50400	0.15 max	0.30-0.60	0.025	0.025	0.25-1.00	8.00-10.00	0.90-1.10	—
P11	K11597	0.05-0.15	0.30-0.60	0.025	0.025	0.50-1.00	1.00-1.50	0.44-0.65	—
P12	K11562	0.05-0.15	0.30-0.61	0.025	0.025	0.50 max	0.80-1.25	0.44-0.65	—
P15	K11578	0.05-0.15	0.30-0.60	0.025	0.025	1.15-1.65	—	0.44-0.65	—
P21	K31545	0.05-0.15	0.30-0.60	0.025	0.025	0.50 max	2.65-3.35	0.80-1.06	—
P22	K21590	0.05-0.15	0.30-0.60	0.025	0.025	0.50 max	1.90-2.60	0.87-1.13	—
P91	K91560	0.08-0.12	0.30-0.60	0.020	0.010	0.20-0.50	8.00-9.50	0.85-1.05	V0.18-0.25 N 0.030-0.070 Ni 0.40 max Al 0.04 max Cb 0.06-0.10
P92	K92460	0.07-0.13	0.30-0.60	0.020	0.010	0.50 max	8.50-9.50	0.30-0.60	V0.15-0.25 N 0.03-0.07 Ni 0.40 max Al 0.04 max Cb 0.04-0.09 W 1.5-2.00 B 0.001-0.006
P122	K92930	0.07-0.14	0.70 max	0.020	0.010	0.50 max	10.00-12.50	0.25-0.60	V0.15-0.30 W 1.50-2.50 Cu 0.30-1.70 Cb 0.04-0.10 B 0.0005-0.005 N 0.040-0.100 Ni 0.50 max Al 0.040 max

Tensile Requirements

Identification Symbol	P1, P2	P12	P91	P92	P122	All Others
Tensile sgrength, min:						
ksi	55	60	85	90	90	60
MPa	380	415	585	620	620	415
Yield strength, min:						
ksi	30	32	60	64	58	30
MPa	205	220	415	440	400	205

Elongation requirements

	All grades except P91 and P92		P91 and P122	
Elongation in 2 in. or 50 mm, (or 4D), min, %:	Longitudinal	Transverse	Longitudinal	Transverse
Basic minimum elongation for wall 5/16 in. (8 mm) and over in thickness, strip tests, and for all small sizes tested in full section.	30	20	20	-
When standard round 2-in. proportionally smaller size specimen with the gage length equal to 4D (4 times the diameter) is use.	22	14	20	13
For strip tests a deduction for each 1/32-in. (0.8 mm) decrease in wall thickness below in. (8 mm) from the basic minimum elongation of, the following percentage points shall be made	1.50	1.00	1.00	-

Pipe Grades

Pipe Grade	Type of Steel	ASTM Specification	
		No.	Grades
CA 55	plain carbon	A 285/A 285M	C
CB 60	plain carbon, killed	A 515/A 515M	60
CB 65	plain carbon, killed	A 515/A 515M	65
CB 70	plain carbon, killed	A 515/A 515M	70
CC 60	plain carbon, killed, fine grain	A 516/A 516M	60
CC 65	plain carbon, killed, fine grain	A 516/A 516M	65
CC 70	plain carbon, killed, fine grain	A 516/A 516M	70
CD 70	manganese-silicon, normalized	A 537/A 537M	1
CD 80	manganese-silicon, quenched and tempered	A 537/A 537M	2
CE 55	plain carbon	A 442/A 442M	55
CE 60	plain carbon	A 442/A 442M	60
CF 65	nickel steel	A 203/A 203M	A
CF 70	nickel steel	A 203/A 203M	B
CF 66	nickel steel	A 203/A 203M	D
CF 71	nickel steel	A 203/A 203M	E
CJ 101	alloy steel, quenched and tempered	A 517/A 517M	A
CJ 102	alloy steel, quenched and tempered	A 517/A 517M	B
CJ 103	alloy steel, quenched and tempered	A 517/A 517M	C
CJ 104	alloy steel, quenched and tempered	A 517/A 517M	D
CJ 105	alloy steel, quenched and tempered	A 517/A 517M	E
CJ 106	alloy steel, quenched and tempered	A 517/A 517M	F
CJ 107	alloy steel, quenched and tempered	A 517/A 517M	G
CJ 108	alloy steel, quenched and tempered	A 517/A 517M	H
CJ 109	alloy steel, quenched and tempered	A 517/A 517M	J
CJ 110	alloy steel, quenched and tempered	A 517/A 517M	K
CJ 111	alloy steel, quenched and tempered	A 517/A 517M	L
CJ 112	alloy steel, quenched and tempered	A 517/A 517M	M
CJ 113	alloy steel, quenched and tempered	A 517/A 517M	P
CK 75	carbon-manganese-silicon	A 299/A 299M	
CP65	alloy steel, age hardening, normalized and precipitation heat treated	A 736/A 736M	2
CP75	alloy steel, age hardening, quenched and precipitation heat treated	A 736/A 736M	3

Heat Treatment on Pipe

Class		Radiography, see Section	Pressure Test, see:
10	none	none	none
11	none	9	none
12	none	9	8.3
13	none	none	8.3
20	stress relieved, see 5.3.1	none	none
21	stress relieved, see 5.3.1	9	none
22	stress relieved, see 5.3.1	9	8.3
23	stress relieved, see 5.3.1	none	8.3
30	normalized, see 5.3.2	none	none
31	normalized, see 5.3.2	9	none
32	normalized, see 5.3.2	9	8.3
33	normalized, see 5.3.2	none	8.3
40	normalized and tempered, see 5.3.3	none	none
41	normalized and tempered, see 5.3.3	9	none
42	normalized and tempered, see 5.3.3	9	8.3
43	normalized and tempered, see 5.3.3	none	8.3
50	quenched and tempered, see 5.3.4	none	none
51	quenched and tempered, see 5.3.4	9	none
52	quenched and tempered, see 5.3.4	9	8.3
53	quenched and tempered, see 5.3.4	none	8.3
60	normalized and precipitation heat treated	none	none
61	normalized and precipitation heat treated	9	none
62	normalized and precipitation heat treated	9	8.3
63	normalized and precipitation heat treated	none	8.3
70	quenched and precipitation heat treated	none	none
71	quenched and precipitation heat treated	9	none
72	quenched and precipitation heat treated	9	8.3
73	quenched and precipitation heat treated	none	8.3

Heat Treatment Parameters

Pipe Grade	ASTM Specification and Grade	Post-Weld Heat-Treatment Temperature Range °F (°C)	Normalizing Temperature, max, °F (°C)	Quenching Temperature, max, °F (°C)	Tempering Temperature, min, °F (°C)	Precipitation Heat Treatment Temperature Range °F (°C)
CA 55	A 285/A 285M (C)	1100-1250 (590-680)	1700 (925)	...	...	...
CB 60	A 515/A 515M (60)	1100-1250 (590-680)	1750 (950)	...	...	...
CB 65	A 515/A 515M (65)	1100-1250 (590-680)	1750 (950)	...	...	...
CB 70	A 515/A 515M (70)	1100-1250 (590-680)	1750 (950)	...	...	...
CC 60	A 516/A 516M (60)	1100-1250 (590-680)	1700 (925)	1650 (900)	1200 (650)[c]	...
CC 65	A 516/A 516M (65)	1100-1250 (590-680)	1700 (925)	1650 (900)	1200 (650)	...
CC 70	A 516/A 516M (70)	1100-1250 (590-680)	1700 (925)	1650 (900)	1200 (650)	...
CD 70	A 537/A 537M (1)	1100-1250 (590-680)	1700 (925)	...	...	...
CD 80	A 537/A 537M (2)	1100-1250 (590-680)	...	1650 (900)	1100 (590)	...
CE 55	A 442/A 442M (55)	1100-1250 (590-680)	1700 (925)	1650 (900)	1200 (650)	...
CE 60	A 442/A 442M (60)	1100-1250 (590-680)	1700 (925)	1650 (900)	1200 (650)	...
CF 65	A 203/A 203M (A)	1100-1175 (590-635)	1750 (950)	...	...	...
CF 70	A 203/A 203M (B)	1100-1175 (590-635)	1750 (950)	...	...	...
CF 66	A 203/A 203M (D)	1100-1175 (590-635)	1750 (950)	...	...	...
CF 71	A 203/A 203M (E)	1100-1175 (590-635)	1750 (950)	...	...	...
CJ 101	A 517/A 517M (A)	1000-1100 (540-590)	...	1725 (940)	1150 (620)	...
CJ 102	A 517/A 517M (B)	1000-1100 (540-590)	...	1725 (940)	1150 (620)	...
CJ 103	A 517/A 517M (C)	1000-1100 (540-590)	...	1725 (940)	1150 (620)	...
CJ 104	A 517/A 517M (D)	1000-1100 (540-590)	...	1725 (940)	1150 (620)	...
CJ 105	A 517/A 517M (E)	1000-1100 (540-590)	...	1725 (940)	1150 (620)	...
CJ 106	A 517/A 517M (F)	1000-1100 (540-590)	...	1725 (940)	1150 (620)	...
CJ 107	A 517/A 517M (G)	1000-1100 (540-590)	...	1725 (940)	1150 (620)	...
CJ 108	A 517/A 517M (H)	1000-1100 (540-590)	...	1725 (940)	1150 (620)	...
CJ 109	A 517/A 517M (J)	1000-1100 (540-590)	...	1725 (940)	1150 (620)	...
CJ 110	A 517/A 517M (K)	1000-1100 (540-590)	...	1725 (940)	1150 (620)	...
CJ 111	A 517/A 517M (L)	1000-1100 (540-590)	...	1725 (940)	1150 (620)	...
CJ 112	A 517/A 517M (M)	1000-1100 (540-590)	...	1725 (940)	1150 (620)	...
CJ 113	A 517/A 517M (P)	1000-1100 (540-590)	...	1725 (940)	1150 (620)	...
CK 75	A 299/A 299M	1100-1250 (590- 680)	1700 (925)	...	...	...
CP65	A 736/A 736M (2)	1000-1175 (540-635)	1725 (940)	...	...	1000-1200 (540-650)
CP75	A 736/A 736M (3)	1000-1175 (540-635)	...	1725 (940)	...	1000-1225 (540-665)

Pipe Grades

Pipe Grade	Type of Steel	ASTM Specification	
		No.	Grades
A 45	plain carbon	A 285	A
A 50	plain carbon	A 285	B
A 55	plain carbon	A 285	C
B 55	plain carbon, killed	A 515	55
B 60	plain carbon, killed	A 515	60
B 65	plain carbon, killed	A 515	65
B 70	plain carbon, killed	A 515	70
C 55	plain carbon, killed, fine grain	A 516	55
C 60	plain carbon, killed, fine grain	A 516	60
C 65	plain carbon, killed, fine grain	A 516	65
C 70	plain carbon, killed, fine grain	A 516	70
D 70	manganese-silicon-normalized	A 537	1
D 80	manganese-silicon-Q+T	A 537	2
E 55	plain carbon	A 442	55
E 60	plain carbon	A 442	60
H 75	manganese-molybdenum-normalized	A 302	A
H 80	manganese-molybdenum-normalized	A 302	B, C or D
J 80	manganese-molybdenum-Q&T	A 533	Cl-1B
J 90	manganese-molybdenum-Q&T	A 533	Cl-2B
J 100	manganese-molybdenum-Q&T	A 533	Cl-3B
K 75	chromium-manganese-silicon	A 202	A
K 85	chromium-manganese-silicon	A 202	B
L 65	molybdenum	A 204	A
L 70	molybdenum	A 204	B
L 75	molybdenum	A 204	C
N 75	manganese-silicon	A 299	...

Heat Treatment on Pipe

Class		Radiography, see Section	Pressure Test, see:
10	none	none	none
11	none	9	none
12	none	9	8.3
13	none	none	8.3
20	stress relieved, see 5.3.1	none	none
21	stress relieved, see 5.3.1	9	none
22	stress relieved, see 5.3.1	9	8.3
23	stress relieved, see 5.3.1	none	8.3
30	normalized, see 5.3.2	none	none
31	normalized, see 5.3.2	9	none
32	normalized, see 5.3.2	9	8.3
33	normalized, see 5.3.2	none	8.3
40	normalized and tempered, see 5.3.3	none	none
41	normalized and tempered, see 5.3.3	9	none
42	normalized and tempered, see 5.3.3	9	8.3
43	normalized and tempered, see 5.3.3	none	8.3
50	quenched and tempered, see 5.3.4	none	none
51	quenched and tempered, see 5.3.4	9	none
52	quenched and tempered, see 5.3.4	9	8.3
53	quenched and tempered, see 5.3.4	none	8.3

Heat Treatment Parameters

Pipe Grade	Specification and Grade °F (°C)	Post-Weld Heat-Treat Temperature Range, °F (°C) °F (°C)	Normalizing Temperature, max, °F (°C)	Quenching Temperature, max,	Tempering Temperature, min,
A 45	A 285A	1100-1250 (590-680)	1700 (925)	...	...
A 50	A 285B	1100-1250 (590-680)	1700 (925)	...	...
A 55	A 285C	1100-1250 (590-680)	1700 (925)	...	...
B 55	A 515-55	1100-1250 (590-680)	1750 (950)	...	...
B 60	A 515-60	1100-1250 (590-680)	1750 (950)	...	...
B 65	A 515-65	1100-1250 (590-680)	1750 (950)	...	...
B 70	A 515-70	1100-1250 (590-680)	1750 (950)	...	...
C 55	A 516-55	1100-1250 (590-680)	1700 (925)	1650 (900)	1200 (650)
C 60	A 516-60	1100-1250 (590-680)	1700 (925)	1650 (900)	1200 (650)
C 65	A 516-65	1100-1250 (590-680)	1700 (925)	1650 (900)	1200 (650)
C 70	A 516-70	1100-1250 (590-680)	1700 (925)	1650 (900)	1200 (650)
D 70	A 537-1	1100-1250 (590-680)	1700 (925)	...	...
D 80	A 537-2	1100-1250 (590-680)	...	1650 (900)	1200 (650)
E 55	A 442-55	1100-1250 (590-680)	1700 (925)	1650 (900)	1200 (650)
E 60	A 442-60	1100-1250 (590-680)	1700 (925)	1650 (900)	1200 (650)
H 75	A 302-A	1100-1250 (590-680)	1800 (980)	...	1100 (590)
H 80	A 302-B, C or D	1100-1250 (590-680)	1800 (980)	...	1100 (590)
J 80	A 533-C11	1100-1250 (590-680)	...	1800 (980)	1100 (590)
J 90	A 533-C12	1100-1250 (590-680)	...	1800 (980)	1100 (590)
J 100	A 533-C13	1100-1250 (590-680)	...	1800 (980)	1100 (590)
K 75	A 202A	1100-1200 (590-650)	...	...	...
K 85	A 202B	1100-1200 (590-650)	...	...	...
L 65	A 204A	1100-1200 (590-650)	...	...	...
L 70	A 204B	1100-1200 (590-650)	...	...	...
L 75	A 204C	1100-1200 (590-650)	...	...	...
N 75	A 299	1100-1200 (590-650)	1700 (925)	...	...

Pipe Grades

Pipe Grade	Type of Steel	ASTM Specification		HB, max
		No.	Grades	
CM-65	carbon-molybdenum steel	A 204/A 204M	A	201
CM-70	carbon-molybdenum steel	A 204/A 204M	B	201
CM-75	carbon-molybdenum steel	A 204/A 204M	C	201
CMSH-70	carbon-manganese-silicon steel, normalized	A 537/A 537M	1	
CMS-75	carbon-manganese-silicon steel	A 299/A 299M	...	...
CMSH-80	carbon-manganese-silicon steel, quenched and tempered	A 537/A 537M	2	
1/2 CR	1/2 % chromium, 1/2 % molybdenum steel	A 387/A 387M	2	201
1CR	1 % chromium, 1/2 % molybdenum steel	A 387/A 387M	12	201
1 1/4 CR	1 1/4 % chromium, 1/2 % molybdenum steel	A 387/A 387M	11	201
2 1/4 CR	2 1/4 % chromium, 1 % molybdenum steel	A 387/A 387M	22	201
3CR	3 % chromium, 1 % molybdenum steel	A 387/A 387M	21	201
5CR	5 % chromium, 1/2 % molybdenum steel	A 387/A 387M	5	225
9CR	9 % chromium, 1 % molybdenum steel	A 387/A 387M	9	241
91	9% chromium, 1% molybdenum, vanadium, columbium	A 387/A 387M	91	241

Heat Treatment on Pipe

Class		Radiography,	Pressure Test:
10	none	none	none
11	none	9	none
12	none	9	8.3
13	none	none	8.3
20	stress relieved, see 5.3.1	none	none
21	stress relieved, see 5.3.1	9	none
22	stress relieved, see 5.3.1	9	8.3
23	stress relieved, see 5.3.1	none	8.3
30	normalized, see 5.3.2	none	none
31	normalized, see 5.3.2	9	none
32	normalized, see 5.3.2	9	8.3
33	normalized, see 5.3.2	none	8.3
40	normalized and tempered, see 5.3.3	none	none
41	normalized and tempered, see 5.3.3	9	none
42	normalized and tempered, see 5.3.3	9	8.3
43	normalized and tempered, see 5.3.3	none	8.3
50	quenched and tempered, see 5.3.4	none	none
51	quenched and tempered, see 5.3.4	9	none
52	quenched and tempered, see 5.3.4	9	8.3
53	quenched and tempered, see 5.3.4	none	8.3

Heat Treatment Parameters

Pipe Grade	ASTM Specification	Post-Weld Heat-Treat Temperature Range (Stress Relieving), °F (°C)	Normalizing Temperature, max unless otherwise noted, °F (°C)	Quenching Temperature, max unless otherwise noted, °F (°C)	Tempering, Temperature, min, °F (°C)
CM-65	A 204/A 204M	1100 to 1200 (590 to 650)	1700 (925)	. . .	. . .
CM-70	A 204/A 204M	1100 to 1200 (590 to 650)	1700 (925)	. . .	. . .
CM-75	A 204/A 204M	1100 to 1200 (590 to 650)	1700 (925)	. . .	. . .
CMSH-70	A 537/A 537M	1100 to 1200 (590 to 650)	1700 (925)	. . .	. . .
CMS-75	A 299/A 299M	1100 to 1200 (590 to 650)	1700 (925)	. . .	. . .
CMSH-80	A 537/A 537M	1100 to 1200 (590 to 650)	. . .	1700 (925)	1100 to 1250 (590 to 675)
1/2CR	A 387/A 387M	1100 to 1300 (590 to 705)	1850 (1010)	1700 (925)	1150 to 1375 (620 to 745)
1CR	A 387/A 387M	1100 to 1350 (590 to 730)	1850 (1010)	1700 (925)	1150 to 1375 (620 to 745)
11/4CR	A 387/A 387M	1100 to 1375 (590 to 745)	1850 (1010)	1700 (925)	1150 to 1375 (620 to 745)
21/4CR	A 387/A 387M	1200 to 1400 (650 to 760)	1850 (1010)	1700 (925)	1250 to 1400 (675 to 760)
3CR	A 387/A 387M	1200 to 1400 (650 to 760)	1850 (1010)	1700 (925)	1250 to 1400 (675 to 760)
5CR	A 387/A 387M	1200 to 1400 (650 to 760)	1850 (1010)	1650 (900)	1300 to 1400 (705 to 760)
9CR	A 387/A 387M	1325 to 1375 (715 to 745)	. . .	. . .	1325 to 1375 (715 to 745)
91	A 387/A 387M	1350 to 1420 (730 to 770)	1900 to 2000 (1040 to 1095)	1900 min (1040 min)	1350 to 1440 (730 to 780)

Chemical Composition

	Composition, %								
	Carbon	Manganese	Phosphorus	Sulfur	Copper	Nickel	Chromium	Molybdenum	Vanadium
Open hearth, electric-furnace or basic-oxygen:	Type S (seamless pipe)								
Grade A	0.25	0.95	0.05	0.045	0.40	0.40	0.40	0.15	0.08
Grade B	0.30	1.20	0.05	0.045	0.40	0.40	0.40	0.15	0.08
Open-heart, electric-furnace or basic-oxygen:	Type E (Electric-resistance-welded)								
Grade A	0.25	0.95	0.05	0.045	0.40	0.40	0.40	0.15	0.08
Grade B	0.30	1.20	0.05	0.045	0.40	0.40	0.40	0.15	0.08
Open-hearth, electric-furnace, or basic oxygen	Type F (furnace-welded pipe)								
Grade A	0.30	1.20	0.05	0.045	0.40	0.40	0.40	0.15	0.08

Tensile Requirements

	Type F Open-Hearth, Basic Oxygen, or Electric-Furnace,	Types E and S	
	Grade A	Grade A	Grade B
Tensile strength, min, psi (MPa)	48 000 (330)	48 000 (330)	60 000 (415)
Yield strength, min, psi, (MPa)	30 000 (205)	30 000 (205)	35 000 (240)
Elongation in 2 in. (50 mm)			

[A] The minimum elongation in 2 in. (50 mm) shall be that determined by the following equation:

$e = 625\ 000\ [1940]\ A^{0.2}\ IU^{0.9}$

where:

e = minimum elongation in 2 in. (50 mm) in percent rounded to the nearest percent,

A = cross-sectional area of the tension specimen, rounded to the nearest 0.01 in.2 (1 mm2), based on the specified outside diameter or the nominal specimen width and specified wall thickness. If the area calculated is equal to or greater than 0.75 in.2 (500 mm2), then the value 0.75 in.2 (500 mm 2) shall be used , and

U = specified tensile strength, psi (MPa).

[B] See Table X4.1 or Table X4.2, whichever is applicable, for minimum elongation values for various size tension specimens and grades.



Chemical Composition

	Composition %		
	Grade A	Grade B	Grade C
Carbon, max	0.25	0.30	0.35
Manganese	0.27-0.93	0.29-1.06	0.29-1.06
Phosphorus, max	0.035	0.035	0.035
Sulfur, max	0.035	0.035	0.035
Silicon, min	0.10	0.10	0.10
Chrome, max	0.40	0.40	0.40
Copper, max	0.40	0.40	0.40
Molybdenum, max	0.15	0.15	0.15
Nickel, max	0.40	0.40	0.40
Vanadium, max	0.08	0.08	0.08

Transverse Elongation

Wall Thickness		Elongation in 2 in. or 50 mm, min, %	
in	mm	Grade A, Transverse	Grade B and C, Transverse
5/16 (0.312)	7.9	25.00	16.50
9/32 (0.281)	7.1	23.75	15.50
1/4 (0.250)	6.4	22.50	14.50

[A] This table gives the computed minimum elongation values for each 1/32-in. (0.8 mm) decrease in wall thickness. Where the wall thickness lies between two values shown above, the minimum elongation value is determined by the following equation:

Grade	Direction of Test	Equation
A	Transverse	$E = 40t + 12.50$
B and C	Transverse	$E = 32t + 6.50$

where:
E = elongation in 2 in. or 50 mm, %, and
t = actual thickness of specimen, in.

Tensile Requirements

	Grade A (Explanatory Note 2)		Grade B		Grade C	
Tensile strength, min, psi (MPa)	**48 000 (330)**		**60 000 (415)**		**70 000 (485)**	
Yield strength, min, psi (MPa)	**30 000 (205)**		**35 000 (240)**		**40 000 (275)**	
	Longitudinal	**Transverse**	**Longitudinal**	**Transvers**	**Longitudinal**	**Transvers**
Elongation in 2 in. or 50 mm, min, %:						
Basic minimum elongation transverse strip tests, and for all small sizes tested in full section	35	25	30	16.5	30	16.5
When standard round 2-in. or 50-mm gage length test specimen is used	28	20	22	12	20	12
For longitudinal strip tests						
For transverse strip tests, a deduction for each1/32-in. (0.8 mm) decrease in wall thickness below 5/16in. (7.9 mm) from the basic minimum elongation of the following percentage shall be made		1.25[C]		1.00[C]		1.00[C]

[A] The minimum elongation in 2 in. (50.8 mm) shall be determined by the following equation:
$e = 625\,000 A^{0.2} / U^{0.9}$
where:
e = minimum elongation in 2 in. (50.8 mm), %, rounded to the nearest 0.5%.
A = cross-sectional area of the tension test specimen, in.2, based on specified outside diameter or nominal specimen width and specified wall thickness rounded to the nearest 0.01 in.^{2} (if the area thus calculated is greater than the value 0.75 in. ^{2} shall be used), and
U = specified tensile strength, psi.

[B] See Table number 4 for minimum elongation values for various size tension specimens and grades.

[C] Table number 3 gives the computed minimum values:

PSL 1 Chemical Composition for Heat and Product Analyses

(1)	(2)	(3)	(4)		(5)
Grade & Class	Carbon, Maximum	Manganese, Maximum	Phosphorus		Sulfur, Maximum
			Minimum	Maximum	
Seamless					
A25, Cl I	0.21	0.60		0.030	0.030
A25, Cl II	0.21	0.60	0.045	0.080	0.030
A	0.22	0.90		0.030	0.030
B	0.28	1.20		0.030	0.030
X42	0.28	1.30		0.030	0.030
X46, X52, X56	0.28	1.40		0.030	0.030
X60, X65, X70	0.28	1.40		0.030	0.030
Welded					
A25, Cl I	0.21	0.60		0.030	0.030
A25, Cl II	0.21	0.60	0.045	0.080	0.030
A	0.22	0.90		0.030	0.030
B	0.26	1.20		0.030	0.030
X42	0.26	1.30		0.030	0.030
X46, X52, X56	0.26	1.40		0.030	0.030
X60	0.26	1.40		0.030	0.030
X65	0.26	1.45		0.030	0.030
X70	0.26	1.65		0.030	0.030

PSL 2 Chemical Composition for Heat and Product Analyses

(1)	(2)	(3)	(4)	(5)
Grade	Carbon, Maximum[a]	Manganese, Maximum[a]	Phosphorus, Maximum	Sulfur, Maximum
Seamless				
B	0.24	1.20	0.025	0.015
X42	0.24	1.30	0.025	0.015
X46,X52,X56	0.24	1.40	0.025	0.015
X60,X65,X70,X800	0.24	1.40	0.025	0.015
Welded				
B	0.22	1.20	0.025	0.015
X42	0.22	1.30	0.025	0.015
X46,X52,X56	0.22	1.40	0.025	0.015
X60e	0.22	1.40	0.025	0.015
X65e	0.22	1.45	0.025	0.015
X70e	0.22	1.65	0.025	0.015
X80e	0.22	1.85	0.025	0.015

Tensile Requirements for PSL 1

(1) Grade	(2) Yield Strength, Minimum psi	(2) Yield Strength, Minimum MPa	(3) Ultimate Tensile Strength, Minimum psi	(3) Ultimate Tensile Strength, Minimum MPa	(4) Elongation in 2 in. (50.8 mm), Minimum, Percent
A25	25.000	(172)	45.000	(310)	a
A	30.000	(207)	48.000	(331)	a
B	35.000	(241)	60.000	(414)	a
X42	42.000	(290)	60.000	(414)	a
X46	46.000	(317)	63.000	(434)	a
X52	52.000	(359)	66.00	(455)	a
X56	56.000	(386)	71.000	(490)	a
X60	60.000	(414)	75.000	(517)	a
X65	65.000	(448)	77.000	(531)	a
X70	70.000	(483)	82.000	(565)	a

Tensile Requirements for PSL 2

(1) Grade	(2) Yield Strength, Minimum psi	(2) Yield Strength, Minimum MPa	(3) Yield Strength, Maximum[b] psi	(3) Yield Strength, Maximum[b] MPa	(4) Ultimate Tensile Strength, Minimum psi	(4) Ultimate Tensile Strength, Minimum MPa	(5) Ultimate Tensile Strength, Maximum[c] psi	(5) Ultimate Tensile Strength, Maximum[c] MPa	(6) Elongation in 2 in. (50.8 mm), Minimum, Percent
B	35.000	(241)	65.000d	(448)	60.000	(414)	110.000	(758)	a
X42	42.000	(290)	72.000	(496)	60.000	(414)	110.000	(758)	a
X46	46.000	(317)	76.000	(524)	63.000	(434)	110.000	(758)	a
X52	52.000	(359)	77.000	(531)	66.000	(455)	110.000	(758)	a
X56	56.000	(386)	79.000	(544)	71.000	(490)	110.000	(758)	a
X60	60.000	(414)	82.000	(565)	75.000	(517)	110.000	(758)	a
X65	65.000	(448)	87.000	(600)	77.000	(531)	110.000	(758)	a
X70	70.000	(483)	90.000	(621)	82.000	(565)	110.000	(758)	a
X80	80.000	(552)	100.000e	(690)	90.000	(621)	120.000	(827)	a

Footnotes to Tables 3A and 3B:

a = The minimum elongation in 2 in. (50.8mm) shall be that determined by the following equation:

U.S. Customary Unit Equation

$$e = 625.000 \frac{A^{0.2}}{U^{0.9}}$$

SI Unit Equation

$$e = 1.944 \frac{A^{0.2}}{U^{0.9}}$$

where

e = minimum elongation in 2 in. (50.8 mm) in percent rounded to the nearest percent.

A = applicable tensile test specimen area, as follows:

a. For both sizes of round bar specimens, 0.20 in.2 (130 mm2);

b. For full section specimens, the smaller of (i) 0.75 in.2 (485 mm2) and (ii) the cross-sectional area of the test specimen, calculated using the specified outside diameter of the pipe and the specified wall thickness of the pipe, rounded to the nearest 0.01 in.2 (10 mm2); and

c. For strip specimens, the smaller of (i) 0.75 in.2 (485 mm2) and (ii) the cross-sectional area of the test specimen, calculated using the specified width of the test specimen and the specified wall thickness of the pipe, rounded to the nearest 0.01 in.2 (10 mm2).

U = specified minimum ultimate tensile strength in psi (MPa).

See Appendix D for the specified minimum elongation values for various tensile specimen sizes and grades.

b = Maximum yield strength for an intermediate grade shall be the maximum for the next higher listed grade.

c = All intermediate grades have a maximum ultimate tensile strength of 110.000 psi (758 MPa).

d = Maximum yield strength for Grade B pipe in sizes subject to longitudinal testing is 72.000 psi (496 MPa).

e = For wall thickness greater than 0.984 inch (25.0 mm), the maximum yield strength shall be determined by agreement between the purchaser and the manufacturer.



Comparison of steel grades

API 5L	ISO 3183 EN 10208	NFA 49.211 NFA 49.411	DNV OS-F101	EEMUA 166	BS 3602	ASTM A 53	ASTM 333	ASTM 106
Grade A					Steel 360	Grade A	Grade 1	Grade A
		TUE 220						
Grade B	L245NB	TUE 250	245	EP 240		Grade B	Grade 3/ Grade 6	Grade B
TUE 275			Steel 430			Grade C		
X 42	L290NB	TUE 290	290	EP290				
X 46		TUE 320						
X 52	L360NB/ L360QB	TUE 360	360	EP 360				
X 56								
X 60	L415QB	TUE 415	415	EP 415				
X 65	L450QB	TUE 450	450	EP 450				
X 70	L485QB		485	EP 485				
X 80	L555QB		555					

*latest issue each



Chemical Composition

Element	Composition. % Low Carbon Steel Tubes	Grade T1
Carbon	0.10-0.20	0.10-0.20
Manganese	0.30-0.80	0.30-0.80
Phosphorus. max.	0.035	0.025
Sulfur. max.	0.035	0.025
Silicon	0.025 max	0.10-0.50
Molybdenum	...	0.44-0.65



Tensile Requirements

	Low Carbon Steel Tubes	Grade T1
Tensile strength. min. ksi (MPa)	47 (324)	55 (379)
Yield strength. min. ksi (MPa)	26 (179)	30 (207)
Elongation in 2 in. or 50 mm (or 4D) min%		
Basic minimum elongation for walls 5/16 in. (7.9 mm) and over in thickness	35	30
When standard round tension test specimen with 2-in. or 50-mm gage length or smaller proportionally sized specimen with the gage length equal to 4D (4 times the diameter) is used	28	22
For longitudinal strip tests. a deduction shall be made for each 1/32-in. (0.80mm) decrease in wall thickness below 3/16 in.(7.9mm) from the basic minimum. elongation of the followning percentage	1.75[A]	1.50[A]



Minimum Elongation Values

Wall thickness in. (mm)	Elongation in 2 in. or 50 mm. min. %[A] Low Carbon Steel Tubes	Grade T1
5/16 (0.312) 7.94	35	30
9/32 (0.281) 7.14	33	28
1/4 (0.250) 6.35	32	27
7/32 (0.219) 5.56	30	26
3/16 (0.188) 4.76	28	24
5/32 (0.156) 3.97	26	22
1/8 (0.125) 3.18	25	21
3/32 (0.094) 2.38	23	20
1/16 (0.062) 1.59	21	18

	Brinell Hardness Number Low Carbon Steel Tubes	Grade T1
Hot-rolled tubes	137	150
Cold-finished tubes	125	137

Chemical Composition

Grade	Composition, %							
	Carbon	Manganese	Phosphorus max	Sulfur, max	Silicon	Chromium	Molybdenum	Others
T4	0.05-0.15 max	0.30-0.60	0.025	0.025	0.50-1.00	2.15-2.85	0.44-0.65	—
T5	0.15 max	0.30-0.60	0.025	0.025	0.50 max	4.00-6.00	0.45-0.65	—
T7	0.15 max	0.30-0.60	0.025	0.025	0.50-1.00	6.00-8.00	0.45-0.65	—
T9	0.15 max	0.30-0.60	0.025	0.025	0.25-1.00	8.00-10.00	0.90-1.10	—
T91	0.08-0.12	0.30-0.60	0.020	0.010	0.20-0.50	8.00-9.00	0.85-1.05	Ni-0.40max V-0.8-0.25 Cb-0.06-0.10 N-0.030-0.070 Al-0.04 max
T11	0.05 min-0.15 max	0.30-0.60	0.025	0.025	0.50-1.00	1.00-1.50	0.44-0.65	—
T21	0.05 min-0.15 max	0.30-0.30	0.025	0.025	0.50 max	2.65-3.35	0.80-1.06	—
T22	0.05 min-0.15 max	0.30-0.60	0.025	0.025	0.50 max	1.90-2.60	0.87-1.13	—

Tensile Requirements

	All grades except T91	Grade T91
Tensile strength. min. lsi (MPa)	60 (414)	85 (585)
Yield strength. min. ksi (MPa)	25 (172)	60 (414)
Elongation in 2 in. or 50 mm (or 4D). min. %		
Basic minimum elongation for walls 5/16 in (7.9 mm) and over in thickness. longitudinal strip tests. and for all small sizes tested in full section	30	20
When standard round 2-in. or 50-mm gage or smaller proportionally sized specimen with the gage length equal to 4D (4 times the diameter) is used.	22	20
For longitudinal strip tests a deduction shall be made for each 1/32 in. (0.79 mm) decrease in wall thickness below 5/16in. (7.9 mm) from the basic minimum elongation of the following percentage points	1.50[A]	1.00

Minimum Elongation Values

Wall Thickness		Elongation in 2 in. or 50 mm. min. %	
in.	mm	All grades except T91	Grade T91
5/16 (0.312)	7.94	30	20
3/32 (0.281)	7.14	28	19
1/4 (0.250)	6.35	27	18
7/32 (0.219)	5.56	26	17
3/16 (0.188)	4.76	24	16
5/32 (0.156)	3.97	22	15
1/8 (0.125)	3.18	21	14
3/32 (0.094)	2.38	20	13
1/18 (0.062)	1.59	18	12



MILL'S APPROVALS

In 1989 TPS Technitube Röhrenwerke GmbH was the first German producer of seamless stainless steel tubes to be ISO certified. Consequently, TPS has more than 14 years of experience with the ISO 9000 system. Therefore, the ISO system is not just a marketing parameter for TPS. It is a useful tool, from which both the company TPS itself and especially the customers are able to benefit significantly.

The quality management systems of the following departments of TPS are ISO 9002 certified:

· Manufacture of seamless tubes and U-bends

· Stock holding of seamless and welded tubes

· Trade of seamless and welded tubes.

· Production of OCTG products
  (Oil Country Tubular Goods),
  primarily for the oil and gas industry.

Besides the **ISO 9000** approval, TPS is approved manufacturer according to Pressure Equipment Directive 97/23/EC Annex. 1,4.3. in addition to this TPS holds the following approvals:

Tubes and U-Tubes for pressure vessels:

· UDT Poland

· ISCIR Romania

For power plants:

· FRAMATOME ANP KTA 1401, QSP 4a and
  AVS D 100/50

For shipbuilding:

· GL - Germanischer Lloyd

For OCTG-Products:

· API 5CT

· API 5D

· API 5L


American Petroleum Institute


ZERTIFIKAT


FRAMATOME ANP

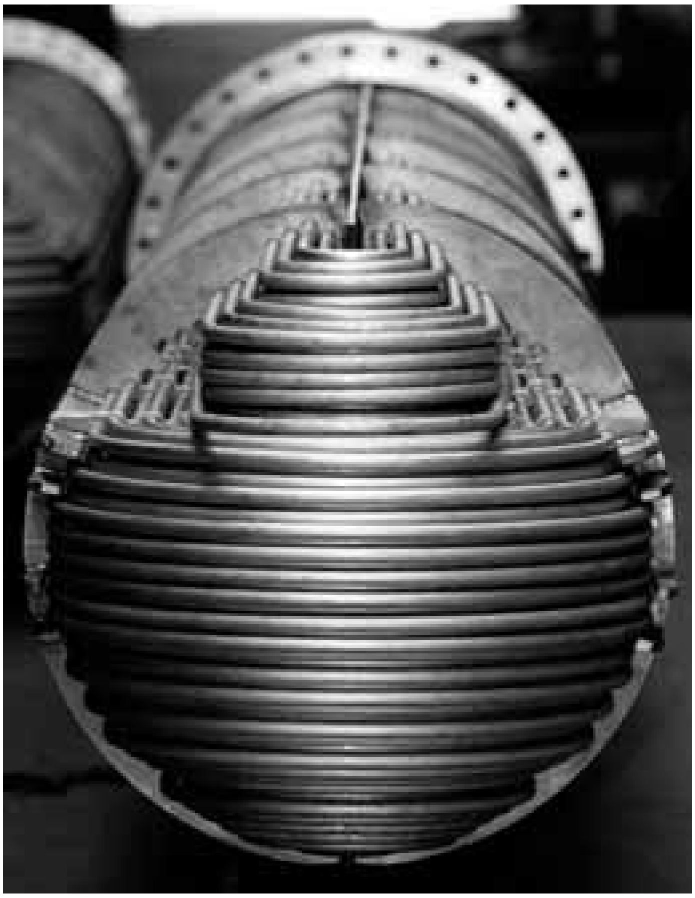
Quality System Certificate

The Standards

ASTM A 213	Seamless Ferritic+Austenitic Alloy-Steel Boiler, Superheater, and Heat Exchanger Tubes
ASTM A 268	Seamless and Welded Ferritic+Martensitic Stainless Steel Tubing for General Service
ASTM A 269	Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A 312	Seamless and Welded Austenitic Stainless Steel Pipes
ASTM A 450	General Requirements for Carbon, Ferritic Alloy, and Austenitic Alloy Steel Tubes
ASTM A 530	General Requirements for Specialized Carbon and Alloy Steel Pipe
ASTM A 789	Seamless and Welded Ferritic+Austenitic Stainless Steel Tubing for General Service
ASTM A 790	Seamless and Welded Ferritic+Austenitic Stainless Steel Pipe
ASTM B 677	Seamless Pipe and Tube (UNS N08904)
ASTM B 668	Seamless Tubes (UNS N08028)
ASTM B 161	Standard Specification for Nickel seamless Pipes and Tubes
ASTM B 163	Seamless Nickel and Nickel Alloy Condenser and Heat Exchanger Tubes
ASTM B 165	Nickel-Copper Alloy Seamless Pipe and Tube
ASTM B 167	Nickel-Chromium-Iron Alloys Seamless Pipe and Tube
ASTM B 407	Nickel-Iron-Chromium Alloy Seamless Pipe and Tube
ASTM B 423	Nickel-Iron-Chromium-Molybdenium-Copper Alloy (UNS N08825) Seamless Pipe and Tube
ASTM B 337	Seamless and Welded Titanium and Titanium Alloy Pipe
ASTM B 338	Seamless and Welded Titanium and Titanium Alloy Tubes for Condensers and Heat- Exchangers
DIN 17456	Seamless Circular Tubes of Stainless Steels with General Quality Requirements; Technical Delivery Conditions
DIN 17458	Seamless Circular Tubes of Stainless Steels with Special Quality Requirements; Technical Delivery Conditions
DIN 2462/1	Seamless Stainless Steel Tubes; Dimensions and Masses per Unit Length
EN ISO 1127	Stainless Steel Tubes - Dimensions, Tolerances and Conventional Masses per Unit Length (replaced DIN 2462)
DIN 2391	Seamless Precision Steel Tubes, Technical Delivery Conditions
DIN 28180	Seamless Steel Tubes for Tubular Heat-Exchangers: Dimensions, Tolerances and Materials
DIN 17850	Titanium, Chemical Compostion
DIN 17861	Titanium and Titanium Alloy Seamless Circular Tubes; Technical Conditions of Delivery
SEW 400	Rolled and Forged Stainless Steels
SEW 470	Heatresisting Rolled and Forged Steels
VdTÜV-WB 418	Rolled and Forged Ferritic-Austenitic Steel (1.4462)
VdTÜV-WB 421	Rolled and Forged Austenitic Steel (1.4539)
VdTÜV-WB 230/2	Tubes Titanium unalloyed and low alloyed
NFA 49117	Seamless Plain End Tubes for Pipe-Lines and Other Uses. Ferritic and Austenitic Stainless Steels Dimensions - Technical Delivery Conditions
NFA 49217	Seamless Tubes for Heat-Exchangers - Stainless Ferritic, Austenitic or Ferritaustenitic Steel Grades Dimensions - Technical Delivery Conditions
BS 3059	Steel Boiler and Superheater Tubes
BS 3605	Austenitic Stainless Steel Pipes and Tubes for Pressure Purposes
BS 3606	Steel Tubes for Heat Exchangers

Selection Data

Standard Grades - Composition - Applications - Properties



Assembled U-tube Heat Exchanger Bundle

1. Austenitic Steels

TP 304=UNS S30400=1.4301=
TPS-INOX-4301-304

The most popular stainless steel has an economic balance of alloying elements to ensure its good cold formability, corrosion resistance, toughness and good mechanical properties with no excessive work-hardening. It performs well in unpolluted atmospheres but can tarnish or lightly rust in damp atmospheres around some industrial and on/offshore locations. The steel has been used extensively for potable water tubing and in fresh feedwater systems where precautions are taken to avoid crevice attack under deposits, etc. Performance in aerated seawater is not good without adequate galvanic or cathodic protection. Stability and toughness at cryogenic temperatures is high.

TP 304H=UNS S30409=TPS-INOX-304H

TP 304H with guaranteed carbon content of min. 0,04% which gives a better creep resistance. Similar oxidation resistance to TP 304. Main applications: Heat exchangers, chemical and petrochemical furnaces.

TP 304L=UNS S30403=1.4306=
TPS-INOX-4306-304L

Low carbon version of TP 304 guaranteed no creep resistance above 500°C. Good high temperature oxidation resistance up to 900°C. General corrosion characteristics are similar to TP 304. Stability and toughness at cryogenic temperatures is high. Main applications: Pipe and heat exchanger tubes in chemical, petrochemical and food industries.

TP 316/TP 316L=UNS S31600/31603=1.4401/1.4404=TPS-INOX-4401/4404-316/316L

These grades belong to the family of 17%Cr12-13%Ni steels containing 2,0-3,0%Mo. This standard grade is used where specific attributes of other members of the family are not necessary - eg. no likelihood of intercrystalline corrosion caused by welding. Special for TP 316L, low carbon content, minimizes chromium carbide preciptation and improves resistance to intercrystalline corrosion. After TP 304/304L type steels, these TP 316/316L grades are the most widely used austenitics. Good high temperature oxidation resistance up to 900°C. In the damp industrial or onshore atmospheres of Europe, they perform better than TP 304/304L and ferritic grades. In low temperature seawater they offer limited resistance to pitting but are susceptible to crevice attack. Their short- and long-time properties at elevated temperatures are also superior to those of comparable TP 304/304L grades. Main applications: Pipe and heat exchanger tubes in chemical and petrochemical plant, in boilers and food industry.

Selection Data

Standard Grades - Composition - Applications - Properties

TP 316H=UNS S31609=TPS-INOX-316H

This grade with guaranteed carbon content of min. 0,04% enhances strength at elevated temperatures. Similar oxidation resistance to TP 316.

Main applications: Heat exchangers, furnaces, chemical and petrochemical plant.



Selection Data

Standard Grades - Composition - Applications - Properties

TP 321=UNS S32100=1.4541=TPS-INOX-4541-321

High carbon steels prone more to intercrystalline attack in weld zones and slower cooling sections. These steel avoids such attacks through its stabilization with Ti. The corrosion behaviour of this alloy in natural environments is very similar to the TP 304/304L alloys. Architecturally, it may not be adequate for near-industrial or onshore locations in Europe. Satisfactory in many low-chloride waters, it is prone to pitting or crevice corrosion in seawater. Water treatment, galvanic protection and deaeration can influence the performance.

TP 321H=UNS S32100=1.4878=TPS-INOX-4878-321H

This is the high carbon version of TP 321 which ensures greater creep resistance. Behaves much the same as TP 321 in oxidation resistance. Main applications: Heat exchangers, furnaces, boilers in chemical and petrochemical plant.

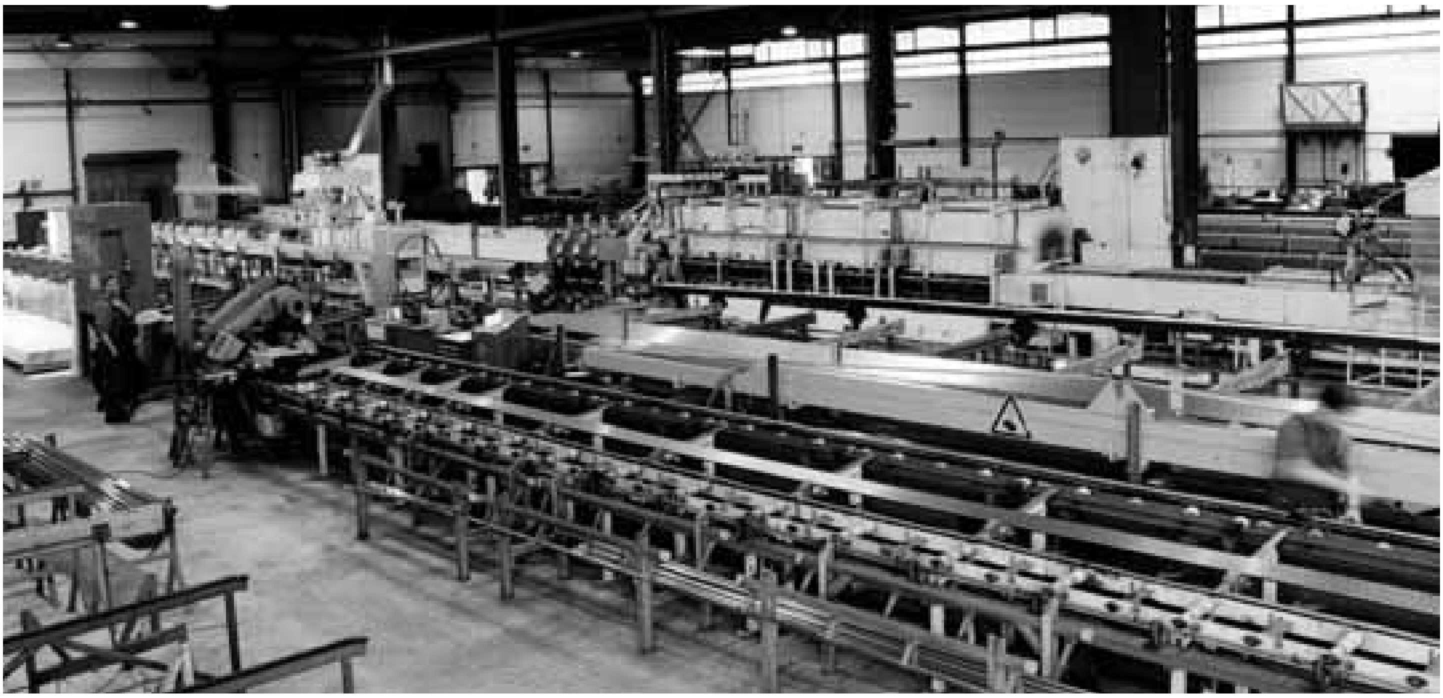
TP 316Ti=UNS S31635=1.4571=TPS-INOX-4571-316Ti

This is one of the family of 17%Cr12-13%Ni steels containing Mo of 2,0-2,4% stabilized with Ti which minimizes chromium carbide precipitation and improves resistance to intergranular corrosion. In the damp industrial or coastal atmospheres of Europe, they perform better than TP 304/304L and ferritic grades. In low temperature seawater they offer limited resistance to pitting but are susceptible to crevice attack. Their short- and long-time properties at elevated temperatures are also superior to those of comparable TP 304/304L grades.

2. Super-Austenitic Steels

TP 904L=UNS N08904=1.4539=TPS-Technichromo 904L

This high-alloy austenitic is very resistant to attack from diluted sulphuric acid, phosphoric acid and acetic acid. It resists pitting in neutral chloride solutions. Its resistance to stress corrosion cracking in some hot chlorides is much superior to that of the lower nickel austenites. This steel has good formability and weldability. This material is present in all common standards like ASTM, DIN, BS and NFA, however with some differences. Design stresses up to 370°C are included in ASME II.



Selection Data

Standard Grades - Composition - Applications - Properties

3. Ferritic and Martensitic Steel

TP 405=UNS S40500=1.4002=TPS-FS-4002-405

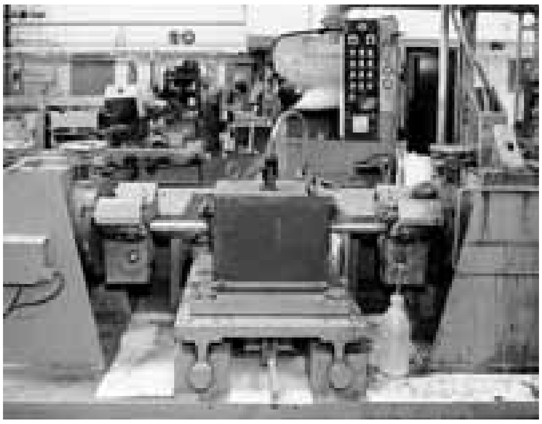
TP 405 is a low carbon, 12% chrome steel, not subject to appreciable hardening through air cooling from high temperatures. This tendency retards the formation of hardening cracks caused by welding. Practically the same corrosion and oxidation resistance as TP 410. Can be machined, drawn, spun and formed without difficulty. Used for applications where hardening upon cooling from high temperatures must be avoided. Has excellent long-time stability up to 1200°F.



Tube straightener

TP 410=UNS S41000=1.4006=TPS-FS-4006-410

This 12% chrome steel is very deep hardening, meaning that hard martensite is formed at cooling rates as slow as 20°C/minute. The hard brittle martensites require prompt tempering at a high enough temperature to improve impact properties. Increasing nickel achieves a better combination of properties. Not very resistant to aerated seawater. Welding is limited because high preheat and immediate postweld tempering is necessary to minimize the risk of hardzone cracking. Type 410 is not equal to the austenitic steels in corrosion resistance, but satisfactorily withstands the effects of the milder acids, alkalies, fresh water and atmospheric conditions. It is the least costly of the stainless steels, containing just enough to yield stainless properties.



Eddy current testing equipment

4. Duplex

UNS S31803=1.4462=TPS-Techniduplex TD2205

A widely used duplex steel combining high strength and corrosion resistance in various organic acids, anorganic acids, aggressive coolingwaters and hydrous H_2S/NaCl mixtures. With a near equal mix of austenite and ferrite, they give yield strength 30% higher and tensile strengths marginally higher than comparable nitrogen-containing austenitics. High resistance to general corrosion and specifically to pitting and crevice corrosion. Their resistance to stress-corrosion cracking in neutral chlorides is superior to that of the austenites. In high chloride acidic or moderately sour environments where hydrogen or sulphide stress cracking is more likely, higher alloyed austenitics need also to be considered. Impact values are high and transition temperatures of base materials vary around -50°C. However, the proportion and orientation of ferrite in welds and base materials may significantly affect toughness at subzero temperatures. Exposure to moderate and high temperatures and less rapid cooling may cause embrittlement.

5. Super Duplex

UNS S32760=TPS-Technisuperduplex TSD2507

UNS S32760 (TSD2507) is a super ferritic-austenitic grade with high mechanical properties and superior corrosion resistance. Besides the ferritic-austenitic structure, TSD2507 has an excellent resistance to pitting and crevice corrosion and is therefore particularly suitable for sea water applications and for process systems on off-shore platforms, respectively in all situations where there is a risk of stress corrosion. The high tensile properties are twice comparing with TP 316 L stainless steel. The service range is between - 50° C up to + 275° C. More detailed informations about this particular grade are described in our TSD 2507 data sheet.

6. Nickel Alloys

UNS N02200=2.4066=TPS-TECHALLOY 200

TECHALLOY 200 is technically pure nickel with good mechanical properties and excellent resistance to corrosive media. Even when exposed to high temperatures, TECHALLOY 200 retains its strength and is ductile at low temperatures. TECHALLOY 200 is a multipurpose grade and is used in applications where alloys are not essential. It also has good magnetic and magnetostrictive properties, high thermal and electrical conductivity as well as low gas content in electronics industry. Furthermore TECHALLOY 200 is of interest for its good weldability.

Chemical composition, mechanical properties and heat treatment

1. Austenitic Steels

Norm	Grade	Chemical composition								
		C	Si	Mn	P	S	Cr	Ni	Mo	Ti
		max.	max.	max.	max.	max.	min-max	min-max	min-max	
ASTM A 213	TP 304	0,080	1,00	2,00	0,040	0,030	18,0 - 20,0	8,0 - 10,5	-	-
DIN 17456/17458	1. 4301	0,070	1,00	2,00	0,045	0,030	17,0 - 19,0	8,5 - 10,5	-	-
NF A 49217	Z 6 CN1809	0,080	1,00	2,00	0,040	0,030	17,0 - 20,0	8,0 - 11,0	-	-
BS 3606	304 S31	0,070	1,00	2,00	0,040	0,030	17,0 - 19,0	8,0 - 11,0	-	-
ASTM A 213	TP 304H	0,04 - 0,10	0,75	2,00	0,040	0,030	18,0 - 20,0	8,0 - 11,0	-	-
ASTM A 213	TP 304 L	0,030	1,00	2,00	0,040	0,030	18,0 - 20,0	8,0 - 12,0	-	-
DIN 17456/17458	1. 4306	0,030	1,00	2,00	0,045	0,030	18,0 - 20,0	10,0 - 12,5	-	-
NF A 49217	Z 2 CN1810	0,030	1,00	2,00	0,040	0,030	17,0 - 20,0	9,0 - 12,0	-	-
BS 3606	304 S11	0,030	1,00	2,00	0,040	0,030	17,0 - 19,0	9,0 - 12,0	-	-
ASTM A 213	TP 316	0,080	1,00	2,00	0,040	0,030	16,0 - 18,0	10,0 - 14,0	2,0 - 3,0	-
DIN 17456/17458	1. 4401	0,070	1,00	2,00	0,045	0,030	16,5 - 18,5	10,5 - 13,5	2,0 - 2,5	-
NF A 49217	Z 2 CND1711	0,070	1,00	2,00	0,040	0,030	16,0 - 18,0	10,0 - 12,5	2,0 - 2,4	-
BS 3606	316 S31	0,070	1,00	2,00	0,040	0,030	16,5 - 18,5	10,5 - 13,5	2,0 - 2,5	-
ASTM A 213	TP 316 L	0,030	1,00	2,00	0,040	0,030	16,0 - 18,0	10,0 - 14,0	2,0 - 3,0	-
DIN 17456/17458	1. 4404	0,030	1,00	2,00	0,045	0,030	16,5 - 18,5	11,0 - 14,0	2,0 - 2,5	-
NF A 49217	Z 2 CND1712	0,030	1,00	2,00	0,040	0,030	16,0 - 18,0	10,5 - 13,0	2,0 - 2,4	-
BS 3606	316 S11	0,030	1,00	2,00	0,040	0,030	16,5 - 18,5	11,0 - 14,0	2,0 - 2,5	-
ASTM A213/A240	TP 316L-Mo	0,030	0,75	2,00	0,040	0,030	16,0 - 18,0	10,0 - 14,0	2,0 - 3,0	-
DIN 17456/17458	1. 4435	0,030	1,00	2,00	0,045	0,025	17,0 - 18,5	12,5 - 15,0	2,5 - 3,0	-
*NF A 35575	Z 2 CND1713	0,030	1,00	2,00	0,040	0,030	16,0 - 18,0	10,5 - 13,0	2,0 - 2,4	-
BS 3606	316 S33	0,030	1,00	2,00	0,040	0,030	16,5 - 18,5	11,0 - 14,0	2,5 - 3,0	-
ASTM A 213	TP 321	0,080	1,00	2,00	0,040	0,030	17,0 - 19,0	9,0 - 12,0	-	5x%C
DIN 17456/17458	1. 4541	0,080	1,00	2,00	0,045	0,030	17,0 - 19,0	9,0 - 12,0	-	5x%C max.0,8
NF A 49217	Z 6 CNT1810	0,080	1,00	2,00	0,040	0,030	17,0 - 20,0	9,0 - 12,0	-	5x%C max.0,6
BS 3606	321 S31	0,080	1,00	2,00	0,040	0,030	17,0 - 19,0	9,0 - 12,0	-	5x%C max.0,8
ASTM A 213	TP 321H	0,04 - 0,10	1,00	2,00	0,040	0,030	17,0 - 19,0	9,0 - 13,0	-	5x%C max.0,6
**SEW 470	1. 4878	0,120	1,00	2,00	0,045	0,030	17,0 - 19,0	9,0 - 12,0	-	4x%C max.0,8
*ASTM A 240	TP 316 Ti	0,080	0,75	2,00	0,045	0,030	16,0 - 18,0	10,0 - 14,0	2,0 - 3,0	5x%C
DIN 17456/17458	1. 4571	0,080	1,00	2,00	0,045	0,030	16,5 - 18,5	10,5 - 13,5	2,0 - 2,5	5x%C
NF A 49217	Z 6 CNDT1712	0,080	1,00	2,00	0,040	0,030	16,0 - 18,0	10,5 - 13,0	2,0 - 2,4	5x%C max.0,6

* tubes manufactured and tested according to ASTM A 213
** tubes manufactured and tested according to DIN 17456
*** tubes manufactured and tested acc. to NFA 49217

2. Super-Austenitic Steels

Norm	Grade	Chemical composition								
		C	Si	Mn	P	S	Cr	Ni	Mo	Ti
		max.	max.	max.	max.	max.	min-max	min-max	min-max	
ASTM B 677	UNS 8904	0,020	1,00	2,00	0,045	0,035	19,0 - 23,0	23,0 - 28,0	4,0 - 5,0	-
VDTÜV 421	1. 4539	0,020	0,70	2,00	0,030	0,015	19,0 - 21,0	24,0 - 26,0	4,0 - 5,0	-
NF A 49217	Z 1 NCDU25.2	0,020	1,05	2,04	0,035	0,025	19,0 - 22,2	24,0 - 27,2	4,0 - 5,1	-

Chemical composition, mechanical properties and heat treatment

	Mechanical properties and heat treatment					
Others	Rp 0,2 N/sq.mm	Rp 1,0 N/sq.mm	Rm N/sq.mm	A5 %	Hardness	Heat treatment
	min.	min.	min-max	min.	HRB max.	
-	205	-	515	35	90	solution 1070° C
-	195	230	500 - 700	40	-	solution 1070° C
-	200	-	490 - 740	45	90	solution 1070° C
-	235	-	490 - 690	30	-	solution 1070° C
-	205	-	515	35	90	solution 1040° C
-	170	-	485	35	90	solution 1070° C
-	180	215	460 - 680	40	-	solution 1070° C
-	175	-	470 - 720	45	90	solution 1070° C
-	205	-	490 - 690	30	-	solution 1070° C
-	205	-	515	35	90	solution 1070° C
-	205	240	510 - 710	40	-	solution 1070° C
-	190	-	490 - 740	45	90	solution 1070° C
-	215	-	490 - 690	30	-	solution 1070° C
-	170	-	485	35	90	solution 1070° C
-	190	225	490 - 690	40	-	solution 1070° C
-	175	-	470 - 720	45	90	solution 1070° C
-	215	-	490 - 690	30	-	-
-	205	-	515	35	90	solution 1040° C
-	190	225	490 - 690	40	-	solution 1070° C
-	195	-	480 - 680	45	-	-
-	245	-	510 - 710	30	-	solution 1070° C
-	205	-	515	35	90	solution 1070° C
-	200	235	500 - 730	35	-	solution 1070° C
-	190	-	490 - 740	45	90	solution 1070° C
-	245	-	510 - 710	30	-	-
-	205	-	515	35	90	solution 1100° C
-	210	-	500 - 750	40	90	quenched
-	205	-	515	35	90	solution 1070° C
-	210	245	500 - 730	35	-	solution 1070° C
-	190	-	490 - 740	45	90	solution 1070° C

	Mechanical properties and heat treatment					
Others	Rp 0,2 N/sq.mm	Rp 1,0 N/sq.mm	Rm N/sq.mm	A5 %	Hardness	Heat treatment
	min.	min.	min-max	min.	HRB max.	
Cu 1,00 - 2,00	220	-	490	35	35	solution 1070° C
Cu 1,00 - 2,00	220	250	520 - 720	35	-	solution 1070° C
Cu 1,00 - 2,00	230	-	550 - 700	40	-	solution 1070° C

Rp 0,2 = Yield Strength - ASTM Standards
Rp 1,0 = Yield Strength - DIN Standards
Rm = Tensile Strength

Chemical composition, mechanical properties and heat treatment

3. Ferritic and Martensitic Steel

Norm	Grade	Chemical composition C	Si	Mn	P	S	Cr	Ni	Mo	Ti
		max.	max.	max.	max.	max.	min-max	min-max	min-max	
ASTM A 268	TP 405	0,080	1,00	1,00	0,040	0,030	11,5 - 14,5	0,500	-	-
DIN 17456	1. 4002	0,080	1,00	1,00	0,045	0,030	12,0 - 14,0	-	-	-
*NF A 35574	Z 6 CA13	0,080	1,00	1,00	0,040	0,030	11,5 - 13,5	-	-	-
ASTM A 268	TP 410	0,150	1,00	1,00	0,040	0,030	11,5 - 13,5	-	-	-
DIN 17456	1. 4006	0,08 - 0,12	1,00	1,00	0,045	0,030	12,0 - 14,0	-	-	-
NF A 49217	Z 12 C13	0,150	1,00	1,00	0,040	0,030	11,5 - 13,5	0,500	-	-
**ASTM A 240	TP 410S	0,080	1,00	1,00	0,040	0,030	11,5 - 13,5	-	-	-

* tubes manufactured and tested according to NFA 49217
** tubes manufactured and tested according to ASTM A 268

4. Duplex

Norm	Grade	Chemical composition C	Si	Mn	P	S	Cr	Ni	Mo	Ti
		max.	max.	max.	max.	max.	min-max	min-max	min-max	
ASTM A789	UNS S31803	0,030	1,00	2,00	0,030	0,020	21,0 - 23,0	4,5 - 6,5	2,5 - 3,5	-
VDTÜV 418	1. 4462	0,030	1,00	2,00	0,030	0,020	21,0 - 23,0	4,5 - 6,5	2,5 - 3,5	-
NF A 49217	Z 2 CND22.05	0,030	1,05	2,04	0,035	0,025	21,0 - 23,2	4,5 - 6,7	2,5 - 3,6	-

5. Super Duplex

Norm	Grade	Chemical composition C	Si	Mn	P	S	Cr	Ni	Mo	Ti
		max.	max.	max.	max.	max.	min-max	min-max	min-max	
ASTM-A 789/790	UNS S32760	0,030	1,00	1,00	0,030	0,010	24,0 - 26,0	6,0 - 8,0	3,0 - 4,0	-

6. Nickel Alloys

Norm	Grade	Chemical composition C	Si	Mn	P	S	Cr	Ni	Mo	Ti
		max.	max.	max.	max.	max.	min-max	min-max	min-max	
ASTM B 161/163	Alloy 200	0,15	0,35	0,35	-	0,01	-	99,0 min.	-	-
DIN 17751	2. 4066	0,08	-	-	-	-	-	99,2 min.	-	-
UNS Grade	N02200	0,15	0,35	0,35	-	0,01	-	99,0 min.	-	-
ASTM B 163/165	Alloy 400	0,300	0,50	2,00	-	0,024	-	63,0 min.	-	-
DIN 17743/17751	2. 4360	0,150	0,50	2,00	-	0,020	-	63,0 min.	-	-
UNS-Grade	N 04400	0,300	0,50	2,00	-	0,024	-	63,0 min.	-	-
ASTM B 163/167	Alloy 600	0,150	0,50	1,00	-	0,015	14,0 - 17,0	72,0 min.	-	-
DIN 17742/17751	2. 4816	0,025-0,100	0,50	1,00	0,020	0,015	14,0 - 17,0	72,0 min.	-	0,30 max.
UNS-Grade	N 06600	0,150	0,50	1,00	-	0,015	14,0 - 17,0	72,0 min.	-	-
ASTM B 163/407	Alloy 800	0,100	1,00	1,50	0,030	0,015	19,0 - 23,0	30,0 - 35,0	-	0,15 - 0,60
*SEW 470	1. 4876	0,120	1,00	2,00	0,030	0,020	19,0 - 23,0	30,0 - 34,0	-	-
UNS-Grade	N 08800	0,100	1,00	1,50	0,030	0,015	19,0 - 23,0	30,0 - 35,0	-	0,15 - 0,60
ASTM B 163/423	Alloy 825	0,050	0,50	1,00	-	0,030	19,5 - 23,5	38,0 - 46,0	2,5 - 3,5	0,60 - 1,20
DIN 17744/17751	2. 4858	0,025	0,50	1,00	0,025	0,015	19,5 - 23,5	38,0 - 46,0	2,5 - 3,5	0,60 - 1,20
UNS-Grade	N 08825	0,050	0,50	1,00	-	0,030	19,5 - 23,5	38,0 - 46,0	2,5 - 3,5	0,6-1,2 ≥ 20xC
ASTM B 729/829	Alloy 8020	0,070	1,00	2,00	0,045	0,035	19,0 - 21,0	32,0 - 38,0	2,0 - 3,0	
DIN E 17744	2.4660	0,070	1,00	2,00	0,025	0,015	19,0 - 21,0	32,0 - 38,0	2,0 - 3,0	Co 1,50
UNS-Grade	N 08020	0,070	1,00	2,00	0,045	0,035	19,0 - 21,0	32,0 - 38,0	2,0 - 3,0	

* tubes manufactured and tested according to DIN 17456

Chemical composition, mechanical properties and heat treatment

	Mechanical properties and heat treatment					
Others	Rp 0,2 N/sq.mm	Rp 1,0 N/sq.mm	Rm N/sq.mm	A5 %	Hardness	Heat treatment
	min.	min.	min-max	min.	HRB max.	
Al 0.1 - 0.3	205	-	415	20	90	annealed 780° C
Al 0.1 - 0.3	250	-	400 - 600	20	-	annealed 780° C
Al 0.1 - 0.3	225	-	420 - 620	20	-	annealed 750-780° C
-	215	-	415	20	90	annealed 780° C
-	250	-	450 - 650	20	-	annealed 780° C
-	210	-	420 - 670	17	-	annealed 780° C
-	205	-	415	30	89	annealed 780° C

	Mechanical properties and heat treatment					
Others	Rp 0,2 N/sq.mm	Rp 1,0 N/sq.mm	Rm N/sq.mm	A5 %	Hardness	Heat treatment
	min.	min.	min-max	min.	HRC max.	
N 0.08 - 0.20	450	-	620	25	31	solution 1070° C
N 0.08 - 0.20	450	-	540 - 880	22	-	solution 1070° C
-	450	-	680 - 880	25	-	solution 1070° C

	Mechanical properties and heat treatment					
Others	Rp 0,2 N/sq.mm	Rp 1,0 N/sq.mm	Rm N/sq.mm	A5 %	Hardness	Heat treatment
		min.	min.	min.	HRC max.	
N 0,2-0,3; Cu 0,5-1,0; W 0,5-1,0	750 - 895	-	550	25	30	solution 1100° C

	Mechanical properties and heat treatment					
Others	Rp 0,2 N/sq.mm	Rp 1,0 N/sq.mm	Rm N/sq.mm	A5 %	Hardness	Heat treatment
	min.	min.	min-max	min.	HRB max.	
Cu 0,25max.	105		380	35	-	annealed
-	100	125	370	40	-	annealed
Cu 0,25max.	105		380	35	-	annealed
Cu 28,0-34,0; Fe 2,5max.	193	-	621	32	80	annealed
Cu 28,0-34,0;Fe 1,0-2,5;Al 0,5max.	180	210	min. 450	35	80	annealed
Cu 28,0-34,0; Fe 2,5max.	193	-	621	32	80	annealed
Cu 0,5max.; Fe 6,0-10,0	241	-	552 - 758	35	92	annealed
Cu 0,5max.; Fe 6,0-10,0	180	210	min. 500	35	90	annealed
Cu 0,5max.; Fe 6,0-10,0	241	-	552 - 758	35	92	annealed
Cu 0,75max.;Al 0,15-0,6;Fe 39,5 min	207	-	517 - 688	30	95	annealed
-	170	-	450 - 700	30	90	annealed
Cu 0,75max.;Al 0,15-0,6;Fe 39,5 min	207	-	517 - 688	30	95	annealed
Cu1,5-3,0;Al 0,2max.;Fe22,0min.	241	-	586 - 793	30	90	annealed
Co 1,0; Cu 1,5-3,0; Al 0,2; Fe Rest	235	265	min. 550	30	90	annealed
Cu 1,5-3,0;Al 0,2max.;Fe Rest	241	-	586 - 793	30	90	annealed
Cu 3-4;Nb+Ta 8xC max.1,0; Fe Rest	240	-	min. 550	30	80	annealed
Cu 3-4;Nb+Ta 8xC max.1,0; Fe Rest	240	-	min. 550	30	80	annealed
Cu 3-4;Nb+Ta 8xC max.1,0; Fe Rest	240	-	min. 550	30	80	annealed

Chemical composition, mechanical properties and heat treatment

ASTM Grade (sim. DIN Grade)	Chemical composition									
	N % max	C % max	H % max	Fe % max	O % max	Al % max	V % max	Pa	Mo	Ni
ASTM B 338 Grade 1	0,03	0,08	0,015	0,20	0,18	-	-	-	-	-
DIN 17861 Ti 1 - 3.7025	0,05	0,06	0,013*	0,15	0,12	-	-	-	-	-
VdTÜV 230/2										
ASTM B 338 Grade 2	0,03	0,08	0,015	0,30	0,25	-	-	-	-	-
DIN 17861 Ti2 - 3.7035	0,05	0,06	0,013*	0,20	0,18	-	-	-	-	-
VdTÜV 230/2										
ASTM B 338 Grade 3	0,05	0,08	0,015	0,30	0,35	-	-	-	-	-
DIN 17861 Ti 3 - 3.7055	0,05	0,06	0,013*	0,25	0,25	-	-	-	-	-
VdTÜV 230/2										
ASTM B 338 Grade 7	0,03	0,08	0,015	0,30	0,25	-	-	0,12 - 0,25	-	-
DIN 17861 Ti 2 Pd - 3.7235	0,05	0,06	0,013*	0,20	0,18	-	-	0,05 - 0,25	-	-
VdTÜV 230/2										
ASTM B 338 Grade 9	0,02	0,08	0,015	0,25	0,15	2,5 - 3,5	2,0 - 3,0	-	-	-
ASTM B 338 Grade 11	0,03	0,08	0,015	0,20	0,18	-	-	0,12 - 0,25	-	-
DIN 17861 Ti1 Pd - 3.7225	0,05	0,06	0,013*	0,20	0,18	-	-	0,15 - 0,25	-	-
VdTÜV 230/2										
ASTM B 338 Grade 12	0,03	0,08	0,015	0,30	0,25	-	-	-	0,2 - 0,4	0,6 - 0,9
DIN 17861 Ti AL3V2,5 - 3.7195	0,04	0,05	0,015	0,30	0,12	2,5 - 3,5	2,0 - 3,0	-	-	-

* In case wallthickness is under 2 mm, the Hydrogenium-content up to 0,015 % is allowed.

ASTM GRADES

ALLOY FEATURES

Grade 1 (unalloyed Titanium): used to increase formability.

Grade 2 (unalloyed Titanium): the most common Titanium grade for cooling water systems; good strength with high ductility, formability, weldability and corrosion resistance.

Grade 3 (unalloyed Titanium): specified when higher levels of strength are required.

Grade 7 (unalloyed Titanium): enhanced resistance to hot brine crevice corrosion and reducing acids, mechanical properties similar to grade 2 alloy.

Grade 9 (Titanium alloy): offers excellent corrosion resistance to sea water and is medium-high strength alloy with highest code design allowables.

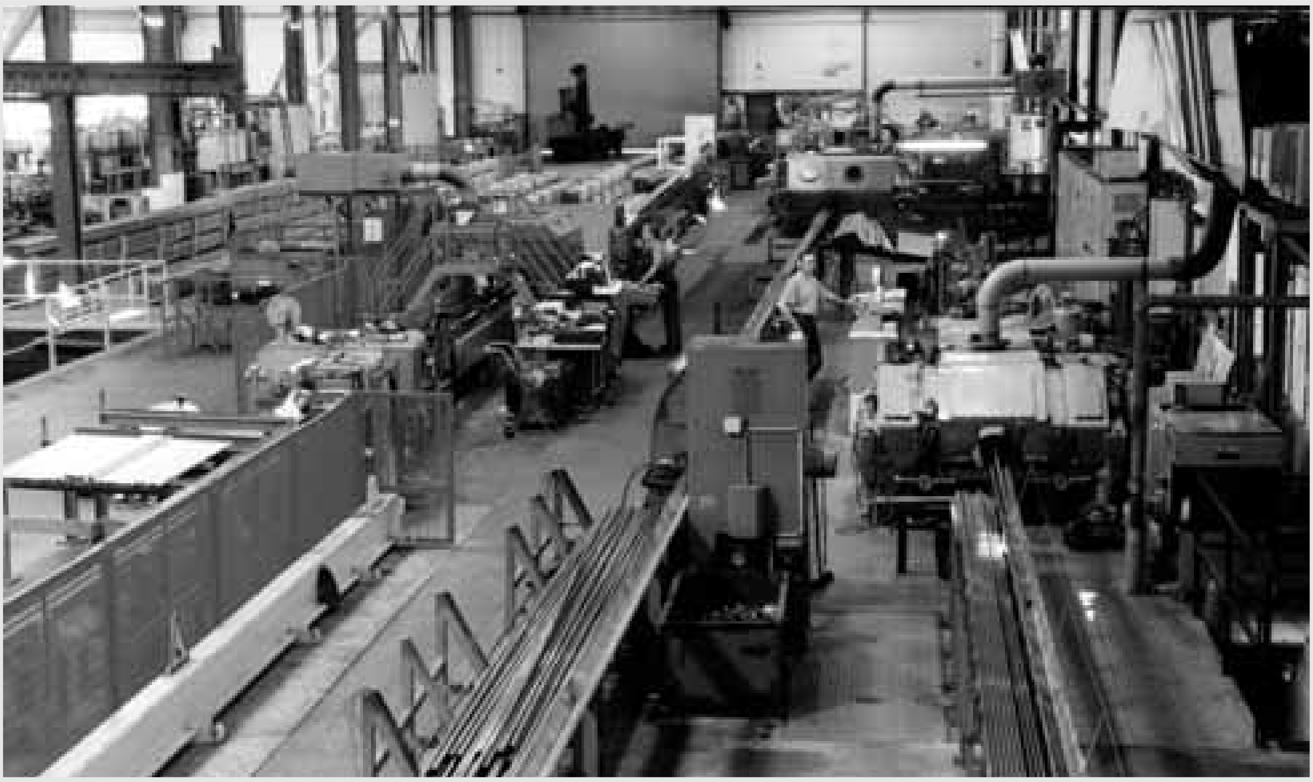
Grade 11 (unalloyed Titanium): mechanical properties are the same as those of grade 1 however, with greater resistance to corrosion against acid chlorides.

Grade 12 (Titanium alloy): more resistant even at temperatures up to 300 C with improved strength and code design allowables over grade 2.

Chemical composition, mechanical properties and heat treatment

			Mechanical properties and heat treatment				
Residuals/ Each	Residuals/ Total	Titanium	Rp 0,2 N/sq.mm min. max.	Rp 1,0 N/sq.mm min.	Rm N/sq.mm min. max.	A 5 % min.	Heat Treatment
0,1	0,4	Rem.	170 - 310	-	240 min.	24	annealed
0,1	0,4	Rem.	180	200	290 - 410	30	soft annealed
0,1	0,4	Rem.	275 - 450	-	345 min.	20	annealed
0,1	0,4	Rem.	250	270	390 - 540	22	soft annealed
0,1	0,4	Rem.	380 - 550	-	450 min.	18	annealed
0,1	0,4	Rem.	320	350	460 - 590	18	soft annealed
0,1	0,4	Rem.	275 - 450	-	345 min.	20	annealed
0,1	0,4	Rem.	250	270	390 - 540	22	soft annealed
0,1	0,4	Rem.	725	-	860	10	annealed
0,1	0,4	Rem.	170 - 310	-	240	24	annealed
0,1	0,4	Rem.	320	350	460 - 590	18	soft annealed
0,1	0,4	Rem.	345	-	483	18	annealed
0,1	0,4	Rem.	520	-	620 min.	15*	soft annealed

* Wall thickness under 1 mm 12 %



View of pilger process area

COMPARISON OF TOLERANCES

Pipes and Heat Exchanger Tubes

Seamless cold-finished tubes in the size range 6,0 up to 60,3 mm OD particularly in heatexchanger and condenser tube dimensions can be supplied in fix- and random lengths, in straight lengths as well as in U-bend execution. TPS seamless tubes in stainless steel, nickel alloys and titanium as mentioned are applied in Chemical-, Petrochemical-, Fertilizer-, Power-, Thermal Processing Plants and Shipbuilding Industry all over the world. Even when applied under most severe operating conditions TPS Seamless Tubes have proved that they meet highest requirements in respect to quality, performance and resistance.

General

Whereas the ASTM A 213 combined with tolerances according to ASTM A 450 exclusively prescribes minimum wall tolerance, the NFA and BS allows both, minimum wall and average wall tolerances.

An exception here presents the DIN standard. There are no indications about tolerances within the production standards of DIN 17456/17458. Those are separately specified within the EN-ISO 1127 (previously: DIN 2462) and DIN 28180 giving several possibilities of average wallthickness, whereby different combinations for O.D. and tolerance of wallthickness can be chosen.

Cold Finished Pipes

Manufacturing Standard	DIN 17456	ASTM A 268	ASTM A 269	ASTM A 312	NFA 49117
Tol. Standard:	EN-ISO 1127 (prior: DIN 2462)	ASTM A 268	ASTM A 269	ASTM A 530	Average wall

Tubes according to these specifications must not be used as heat exchanger tubes.

Cold Finished Heat Exchanger Tubes

Manufacturing Standard	DIN 17458/AD-W2 VD-TÜV-WB	ASTM A 213	NFA 49217
Tol. Standard:	EN-ISO 1127 (previously:DIN 2462)	ASTM A 450 (min. wall)	Average wall
	DIN 28180		Minimum wall

Tubes according to these specifications can be used as line pipes as well.

TPS Technitube Röhrenwerke seamless tube production mill and TechniPark



COMPARISON OF TOLERANCES

Cold Finished Pipes and Tubes

Specification		Outside Diameter				Wallthickness
ASTM						
A 450		< 25,4mm	< 38,1mm	< 50,8mm	> 50,8 mm	
		+/- 0,10mm	+/- 0,15mm	+/- 0,20mm	+/-0,25mm	-0/+20% (min. wall)
						(average wall +/-10% not included)
A 530				< 48,3mm	> 48,3mm	
				+0,4/-0,8mm	+/-0,8mm	+/-12,5%
A 269		< 38,1mm		< 63,5mm		
		+/- 0,13mm		+/-0,25mm		+/-10%
EN-ISO 1127 (previously: DIN 2462)						
Tol.class	TC D2	+/-1,00%	min.+/-0,5mm			T 2 +/-12,5% min. +/-0,40 mm
	TC D3	+/-0,75%	min. +/-0,3mm			T 3 +/-10% min. +/-0,20 mm
	TC D4	+/-0,50%	min. +/-0,1mm			T 4 +/-7,5% min. +/-0,15 mm
DIN 28180 (valid only for heatexchanger dimensions)						
Tol.class		16-20mm	25mm	30mm	38mm	< 2 mm / > 2 mm
	TC 1	+/-0,10mm	0,12mm	0,15mm	0,20mm	+/-0,2mm / +/-10%
	TC 2	0,30mm	0,30mm	0,30mm	0,40mm	+/-0,2mm / +/-10%
	TC 3	-	-	-	-	+/-0,2mm / +15/-10%
NFA	**Quality F (cold finished)**					
49117	Quality F (cold finished)	+/-0,75% with a minimum tolerances of +/-0,30mm				+/-10% with a minimum of +/-0,20 mm
49217		< 25,4mm	< 38,1mm	< 50,8mm	>50,8mm	
	Ferritic	+/-0,10mm	+/-0,15mm	+/-0,20mm	+/-0,50%	normally +/-10%
	Austenitic+Austenitic-Ferritic	+/-0,25mm	+/-0,25mm	+/-0,25mm	+/-0,50%	(on request:-0+20% min. wall)
BS	**CFS**					
3059	Part 2 Austenitic	+/-0,50% with a minimum tolerances of +/-0,15mm				+/-10%(<3,25 mm) +/-7,5%(>3,25 mm)
3605	Part 1 Austenitic	+/-0,75% with a minimum tolerances of +/-0,20mm				+/- 10% min. +/- 0,15 mm
3606		< 25mm	< 38mm	< 50mm		
	Ferritic	+/-0,10mm	+/-0,15mm	+/-0,20mm		+/-10%
	Austenitic	+/-0,15mm	+/-0,15mm	+/-0,20mm		(on request:-0/+20% or -0/+22%)



BWG AND SWG DIMENSIONS AND WEIGHTS

For stainless steel only

BWG (Birmingham wire gauge)

Wall thickness									
BWG		22	20	18	16	14	12	11	10
mm		0.711	0.889	1.245	1.651	2.108	2.769	3.048	3.404
		Weight in kg/m							
outside diameter									
inches	mm								
1/4“	6.350		0.122	0.159	0.194				
5/16“	7.950		0.157	0.209	0.260				
3/8“	9.525		0.192	0.258	0.326	0.392			
1/2“	12.700	0.213	0.263	0.357	0.457	0.559	0.688	0.737	
5/8“	15.875	0.270	0.334	0.456	0.588	0.727	0.908	0.979	
3/4“	19.050		0.404	0.555	0.719	0.894	1.130	1.220	1.330
7/8“	22.225	0.383	0.475	0.654	0.851	1.060	1.350	1.460	1.600
1“	25.400	0.440	0.546	0.752	0.982	1.230	1.570	1.710	1.870
1 1/4“	31.750	0.553	0.687	0.950	1.240	1.570	2.010	2.190	2.420
1 1/2“	38.100	0.666	0.828	1.150	1.510	1.900	2.450	2.680	2.960
1 3/4“	44.450	0.779	0.970	1.350	1.770	2.240	2.890	3.160	3.500
2“	50.800	0.892	1.110	1.540	2.030	2.570	3.330	3.650	4.040
2 1/2“	63,500			1.940	2.560	3.240	4.210	4.610	5.120

SWG (Standard wire gauge)

Wall thickness									
SWG		22	20	18	16	14	12	11	10
mm		0.711	0.914	1.219	1.626	2.032	2.642	2.946	3.251
		Weight in kg/m							
outside diameter									
inches	mm								
1/4“	6.350		0.124	0.157	0.192				
5/16“	7 950		0.161	0.205	0.257				
3/8“	9.525		0.197	0.253	0.321	0.381			
1/2“	12.700	0.213	0.270	0.350	0.451	0.543	0.665	0.720	
5/8“	15.875	0.270	0.342	0.447	0.580	0.704	0.875	0.954	
3/4“	19.050		0.415	0.544	0.709	0.866	1.090	1.190	1.290
7/8“	22.225	0.383	0.488	0.641	0.838	1.030	1.300	1.420	1.550
1“	25.400	0.440	0.560	0.738	0.967	1.190	1.510	1.660	1.800
11/4“	31.750	0.553	0.706	0.931	1.230	1.510	1.930	2.130	2.320
11/2“	38.100	0.666	0.851	1.130	1.480	1.840	2.350	2.590	2.840
13/4“	44.450	0.779	0.996	1.320	1.740	2.160	2.770	3.060	3.350
2“	50.800	0.892	1.140	1.510	2.000	2.480	3.190	3.530	3.870
2 1/2“	63.500			1.900	2.520	3.130	4.030	4.470	4.910

ASA PIPE SCHEDULE

Wallthickness and weight per meter

ANSI/ASME B36.19 Stainless steel pipe

NB	O.D. mm	5s	5	10s	10	20	30	STD 40s	40	60	XS 80s	80	100	120	140	160	XXS
1/8	10,3							1,73	identical with STD and 40S		2,41	identical with XS and 80S					
								0,37			**0,47**						
1/4	13,7							2,24			3,02						
								0,64			**0,82**						
3/8	17,2							2,31			3,20						
								0,87			**1,12**						
1/2	21,3	1,65	1,65	2,11	2,11			2,77			3,73					4,75	7,47
		0,81	**0,81**	**1,02**	**1,02**			**1,29**			**1,64**					**1,97**	**2,59**
3/4	26,7	1,65	1,65	2,11	2,11			2,87			3,91					5,54	7,82
		1,03	**1,03**	**1,30**	**1,30**			**1,71**			**2,23**					**2,93**	**3,69**
1	33,4	1,65	1,65	2,77	2,77			3,38			4,55					6,35	9,09
		1,31	**1,31**	**2,13**	**2,13**			**2,54**			**3,29**					**4,30**	**5,53**
1 1/4	42,2	1,65	1,65	2,77	2,77			3,56			4,85					6,35	9,70
		1,67	**1,67**	**2,73**	**2,73**			**3,44**			**4,53**					**5,69**	**7,88**
1 1/2	48,3	1,65	1,65	2,77	2,77			3,68			5,08					7,14	10,16
		1,93	**1,93**	**3,16**	**3,16**			**4,11**			**5,49**					**7,35**	**9,69**
2	60,3	1,65	1,65	2,77	2,77			3,91			5,54					8,71	11,07
		2,42	**2,42**	**3,99**	**3,99**			**5,52**			**7,60**					**11,26**	**13,65**

1,65 = Wallthickness in mm **2,42 = weight in kg/m**



Packing in bundles ▼ and with sheet plastic cover ▶



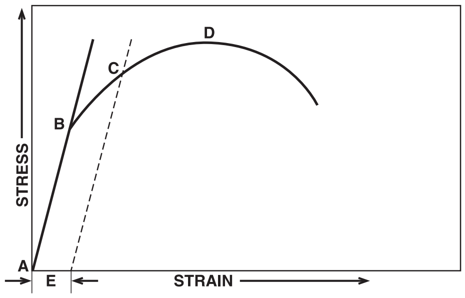
MECHANICAL-, NON-DESTRUCTIVE- AND CORROSION TESTS

TPS stainless steel, nickel and titanium alloy tubes are manufactured on most modern production equipment, whereby the applied production methods assure the highest possible standard of quality (certified acc. to ISO 9002). Morever, for continuous quality assurance and -control, our independent testing department is equipped with most modern testing facilities, i.e. tensile test machinery, hardness measuring apparatus, ultrasonic and eddy-current testing line, coldwater-pressure test equipment and many other modern destructive and non-destructive test instruments.
All tests carried out on material or finished products can be split into three major categories: Mechanical tests, Non-Destructive tests and Corrosion tests.
The tests mentioned below will be carried out according to the relevant material specification or on special request to be agreed upon in the purchase order.

MECHANICAL TESTS

Tensile Test

A longitudinal specimen of known cross sectional area is taken from the material and gripped at each end, pulled apart until rupture occurs. By recording the load applied and the extension during loading a Stress-Stain Graph can be plotted (see diagram).



A-B Elastic deformation range

B Elastic limit

C Proof stress

D Ultimate tensile stress

E Specified strain

From this graph the following values can be computed:

Ultimate tensile strength (D)
The maximum load applied during the test divided by the original cross-sectional area of the test-piece

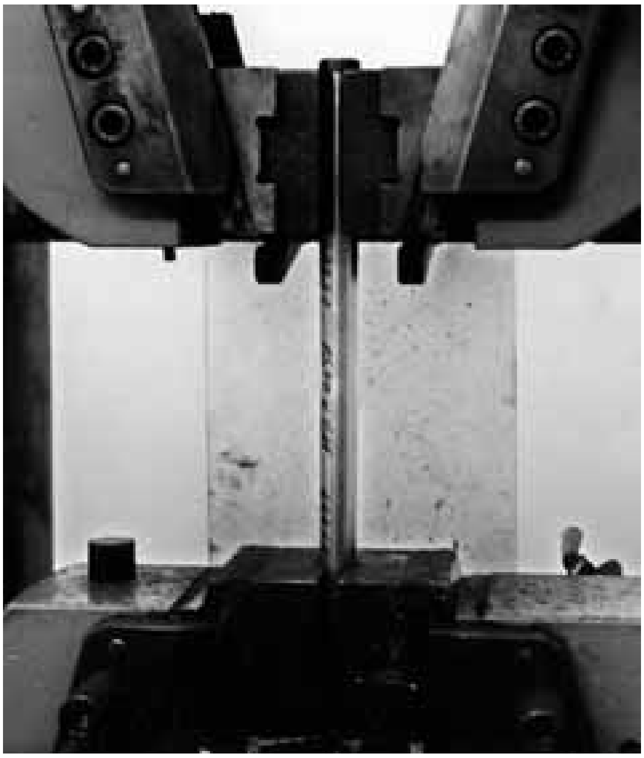
Proof stress (C)
This is the load at which the sample is permanently elongated by a specific percentage of the original length (e.g.0.2%).

Elastic limit (B)
The highest load at which there is no permanent deformation of the test piece.

Yield point
The lowest stress at which the elongation of the test-piece proceeds without any increase in load.

Modulus of elasticity
In the tensile test, the ratio between stress and strain within the elastic deformation range is known as Young´s modulus. From the ruptured test-piece, two other values can be computed

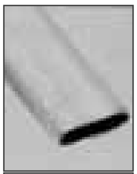
Elongation
This is the extension of the test-piece expressed as a percentage of its original length



Tensile testing

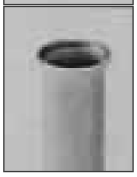
Reduction of areas
This is the reduction in cross-sectional area of the test-piece after tensile fracture expressed as a percentage of the original cross-sectional area.

MECHANICAL-, NON-DESTRUCTIVE- AND CORROSION TESTS



Flattening Test

This is usually applied to tube and involves flattening sample of tube between two parallel faces without showing flaws or cracks. The length of the test-piece and degree to which it is to be flattened is specified. The latter usually expressed in terms of the wall thickness of the tube.



Flare or Drift Test

This is a form of ductility test and applies to tube. The end of the tube is required to be expanded by a specified increase in diameter without splits or cracks. The included angle of drift is also specified.

Hardness Tests

These tests determine the resistance of material to indentation.

Brinell hardness test

A standard size hardened steel ball is indented into the surface of material by an applied standard load for a duration of 15 seconds. The diameter of the impression is measured accurately by microscope and the hardness value calculated.

Rockwell hardness test

This determines hardness by measuring the depth to which a diamont cone or hardened steel ball, under specific load, penetrates the material. The hardness number is indicated on a scale according to the load applied.

Vickers diamond hardness test

This determines hardness by measuring the impression left in material by diamond pyramid under a standard load for a specified time. The square impression is measured, accurately, diagonally and is area calculated. The hardness value is calculated.



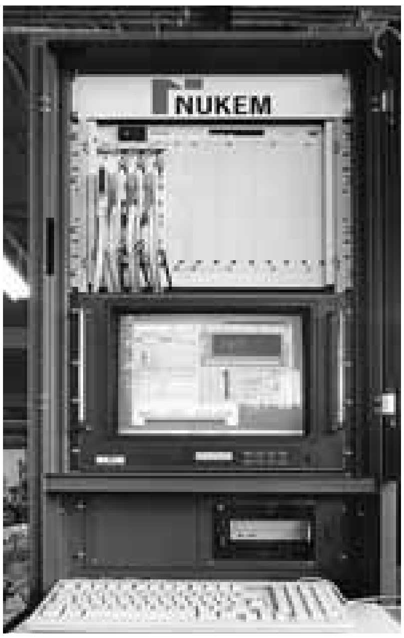
Hardness Testing

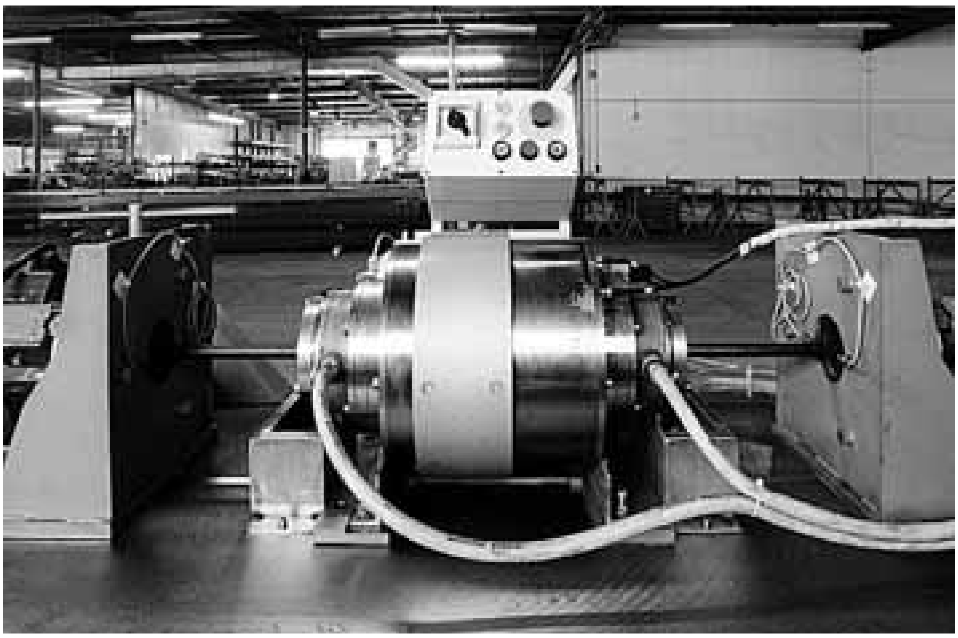
NON-DESTRUCTIVE TESTS

Ultrasonic Testing

acc. to ASTM-E213 / SEP1915; 1918; 1919

This test involves ultrasonic sound waves being aimed, via a coupling medium, at the material to be tested. A proportion sound is bounced back at the coupling medium/material interface but the remainder enters the material and is bounced back from the internal surface, to the external surface, where a transducer converts the sound into electrical energy. This is then monitored on a cathode





Ultrasonic testing equipment

MECHANICAL-, NON-DESTRUCTIVE- AND CORROSION TESTS

ray tube. If a calibrated standard is shown on the tube, any deviation from the standard will be immediately visible, thus indicating cracks or internal defects.

Eddy-Current Testing

acc. to ASTM-E426 / SEP1925

This involves inducing eddy currents into the material by exciting a coil which surmounts two narrow search coils surrounding the material. Any discontinuities in material are found by comparing the electrical conditions that exist in the two search coils. The fault signals are amplified and can be shown on a cathode ray tube or as an audible signal.

Hydrostatic Test

acc. to tube specification

This is used to test the manufactured items under a test pressure equivalent or greater than pressure encountered in operation. It involves filling the tube with demineralized water, which cannot be compressed, and increasing the pressure, to that specified, inside the tube. The pressure is transmitted to the tube by the water and therefore a pressure to which the tube has been tested is obtained.

Dye-penetrant Test

acc. to ASTM-E165 / DIN 54152

This is used to detect cracks and involves spraying a dye on the area to be tested. After allowing time for penetration the surplus dye is removed and the area is then sprayed with a white developer. Any faults are releaved as coloured lines or spots caused by the developer absorbing the dye seeping from the cracks.

PMI (positive material identification) - Mix-Up Control

PMI / Mix-Up Control is carried out by spectrotest. Spectrotest is used for "Mix-Up Control" work, testing of a material quality is carried out on a Yes / No basis in relation to the quality of the reference material.

The operator is prompted to "Recalibrate", "Test the reference material" and " Carry out mix-up control" by the instrument.

Microstructure test according to ASTM E 112 / DIN 50601.



These test methods of determination of average grain size in metallic materials are primarily measuring procedures and, because of their purely geometric basis, are independent of the metal or alloy concerned. The basis procedures may also be used for the estimation of average grain, crystal or cell size in nonmetallic materials. The comparison method by planimetric (or Jeffries) procedure is used if the structure to the material approaches the appearance of one of the standard comparison charts.



Micro structure photography

MECHANICAL-, NON-DESTRUCTIVE- AND CORROSION TESTS

CORROSION TESTS

Various corrosion tests are available using different corrosive environments to indicate the performance of material under heavy duty applications.

Strauss Test

acc. to ASTM-A262 Practice E / EN ISO 3651-2 / SEP 1877

This test detects inter-crystalline corrosion and involves the use of boiling copper sulphate/sulphuric acid solution which must contain solid electrolytic copper. The test samples are immersed in the solution for 15 hours. After immersion the samples are bent through 90 . Those samples which bend without cracking are considered resistant to inter-crystalline corrosion.



Corrosion Testing

Huey Test

acc. to ASTM-A262 Practice C / SEP1870

This test detects the susceptibility to intergranular attack and involves the use of boiling nitric acid. The test samples are immersed in the solution at a concentration of 65% nitric acid by weight for five 48 hour periods. The effects of the acid on the material is measured by the loss in weight after each period and the corrosion rate assessed as a thickness loss in a given time.

TYPES OF CORROSION

Many different types of corrosion exist and positive identification of the results of corrosion often pinpoint the cause and consequently a potential remedy. The following are the more generally encountered:

Stress Corrosion

The presence of residual stresses within a fabrication, caused by deformation, welding etc. may produce an accelerated form of corrosive attack, especially when the environment contains chloride. This phenomenon is more prevalant in austenitic steels than those with a duplex structure. This type of corrosive attack may be obviated by a stress relieving annealing at a temperature of 880 C or above.

Intercrystalline Corrosion

This type of corrosion is to be found fundamentally in the austenitic steels. If an austenitic stainless steel is maintained during a certain period of time at temperatures between 400 and 900 C a precipitation of carbides at the grain boundaries is provoked which depletes the chrome of the adjoining areas. If, in these conditions, the steel is subjected to reactive media, there may be intergranular oxidation known as intercrystalline corrosion. It is essential to avoid slow cooling through the critical temperature range. The cause of the precipitation may be incorrect heat treatment, defective heating or cooling during the transformation of the steel, heating during welding.

Selective Corrosion or Pitting

When a series of conditions forces the passivity to disappear from some points of the surface of a stainless steel they transform into anodes giving way to the creation of galvanic pairs. In general it is shown by very fine pitting which rapidly develops in depth and in length. A typical case of this corrosion is produced by sea water in almost all steels, and it is dangerous because it is difficult to detect. The chlorides, bromides and hipochlorides are those which present the greatest aggressivity. The composition of the steel and its structure are factors which also influence this type of corrosion. If dirt accumulates on the surface of a stainless steel, the access of oxygen is avoided on the covered areas, pitting forming as a result of the loss of passivity. The austenitic steels with molybdenium show good resistance and this improves if they are copper alloyed. Nitrogen also reduces the tendency towards corrosion by pitting.

INSPECTION DOCUMENTS

Types of Inspection Documents DIN EN 10204 (previously DIN 50.049)

1 General

This European Standard defines the different types of inspection documents supplied to the purchaser, in accordance with the requirements of the order, for the delivery of metallic products.

2 Inspection documents drawn up from inspection and tests carried out by personnel authorized by the manufacturer and who may be involved in the manufacturing department

Certificate of compliance with the order 2.1/EN 10204

Document in which the manufacturer certifies that the products supplied are in compliance with the requirements of the order, without mention of any test results.

The certificate of compliance with the order is a document drawn up on the basis of non-specific inspection and testing.

Test report 2.2/EN 10204

Document in which the manufacturer certifies that the products supplied are in compliance with the requirements of the order and in which he supplies test results based on non-specific inspection and testing.

Specific test report 2.3/EN 10204

Document in which the manufacturer certifies that the products supplied are in compliance with the specifications of the order and in which he supplies test results based on specific inspection and testing.

(The specific test report is only used by a manufacturer who does not have an authorized quality control department operating independently of the manufacturing department).

3 Inspection documents drawn up from inspection and tests carried out or supervised by authorized personnel independent of the manufacturing department, and based on specific testing

Inspection certificate 3.1.

Document issued on the basis of inspection and tests carried out in accordance with the technical specifications of the order or the official regulations and the corresponding technical rules. The tests shall be carried out on the products supplied or the products in the inspection unit, of which the consignment constitutes a part.

The inspection unit is set by the product standard, the official regulations and corresponding technical rules or by the order.

There are different types:

Inspection certificate 3.1.B/EN 10204

is issued by the department independent of the manufacturing department and validated by an authorized representative of the staff independent of the manufacturing department.

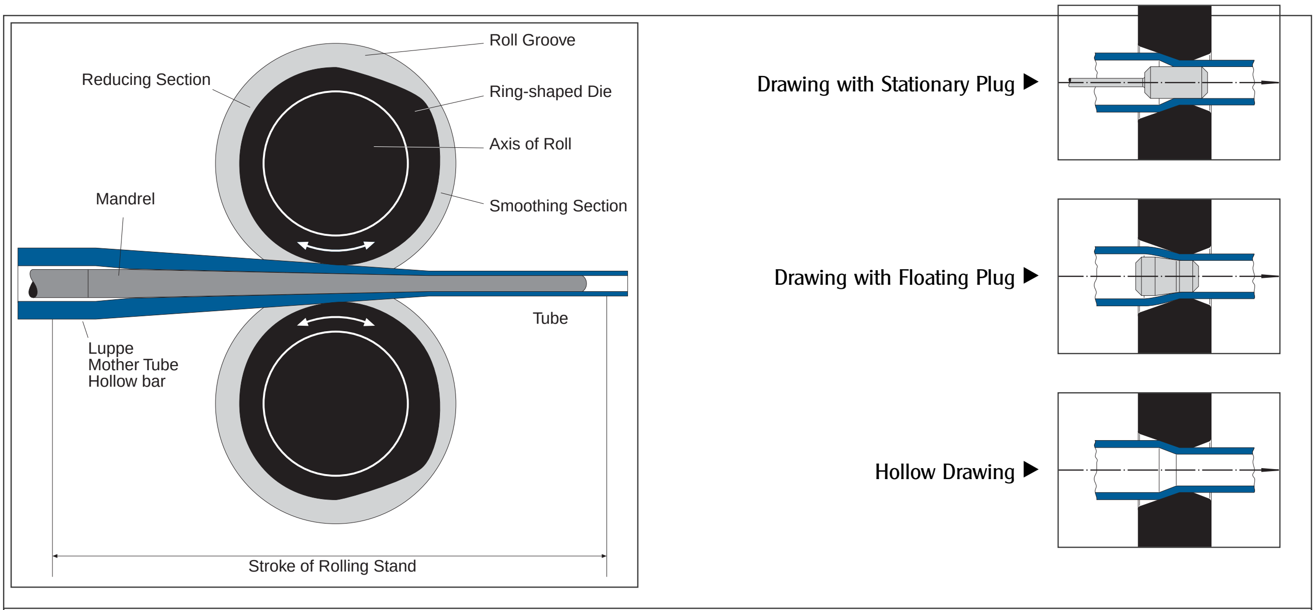
Inspection certificate 3.1.C/EN 10204

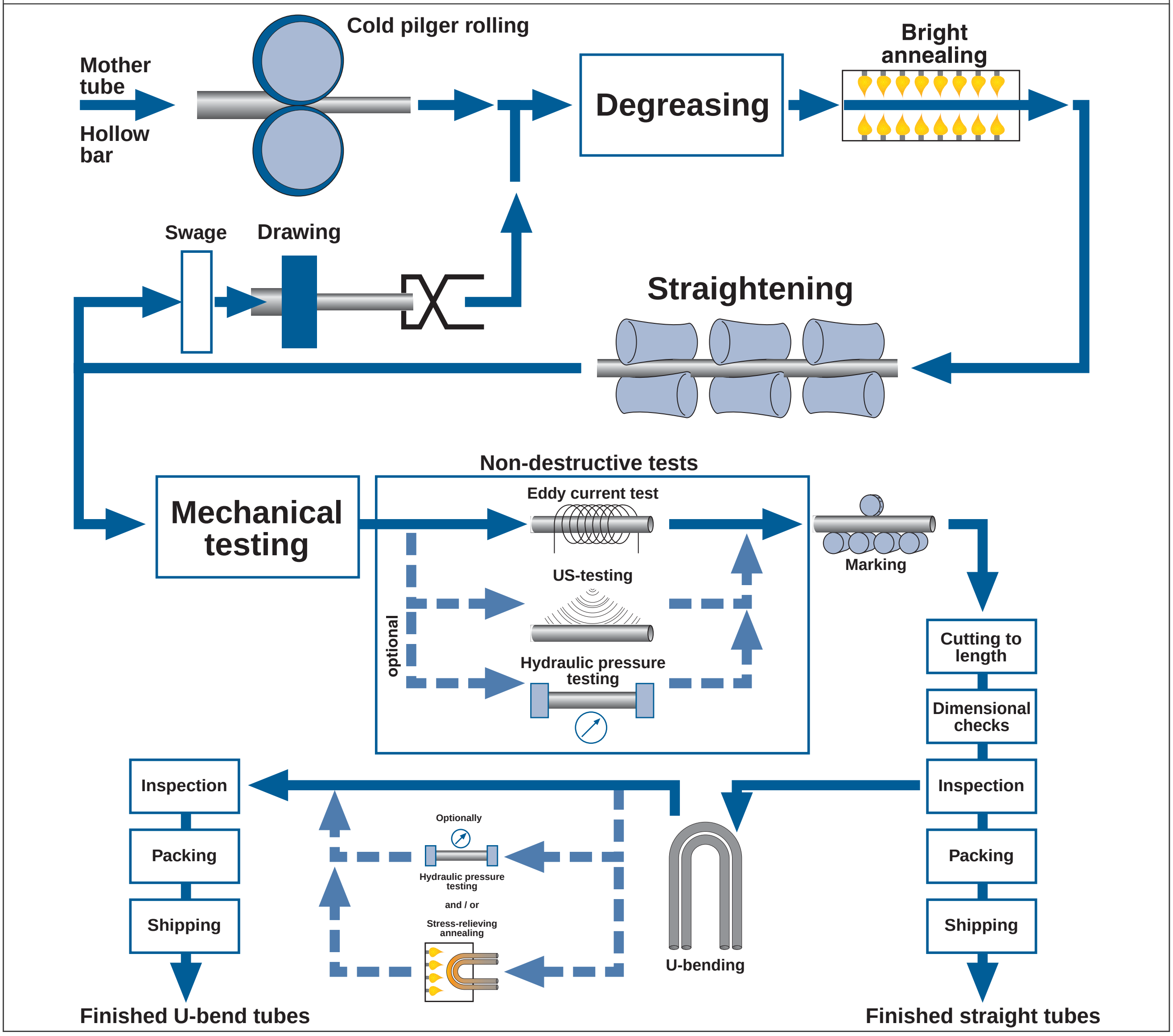
is issued and validated by an authorized representative of the purchaser, in accordance with the specifications of the order.

Inspection report 3.2/EN 10204

Where the inspection certificate is validated, following special agreement, both by the manufacturer´s authorized representative and the purchaser´s authorized representative, it is known as the inspection report.

PRODUCTION PROCESS





Chemical composition and mechanical properties

STANDARD	ASTM-A	179	214	192	226
Manufacturing Process		Seamless	ERW	Seamless	ERW
Chemical Analysis					
C	%	0.06-0.18	0.18 max	0.06-0.18	0.06-0.18
Mn	%	0.27-0.63	0.27-0.63	0.27-0.63	0.27-0.63
P max	%	0.035	0.035	0.035	0.035
S max	%	0.035	0.035	0.035	0.035
Si max	%			0.25	0.25

Mechanical Properties					
Tensile Strength	min KSI [MPA]	47 [325]	47 [325]	47 [325]	47 [325]
Yield Strength	min KSI [MPA]	26 [180]	26 [180]	26 [180]	26 [180]
Elongation in 2 in.	min %	35	35	35	35

Comparison of International Specifications & Grades

ASTM	DIN	BS	NFA	JIS
A 179	17175 ST 35.8/I	3602 Pt1 3059 Pt2 St 360 CAT2	A 49215 TU 37C	G 3461 STB 340
A 192	17175 ST 35.8/I	3602 Pt1 3059 Pt2 ST 360 CAT2	A 49215 TU 37C	JIS G3461 STB 340
A 214	17177 ST 37.8/I	BS 3059 Pt2 3602 Pt1 ERW 360 CAT2	A 49242 A 49245 TS 37C	G 3461 STB 340
A 226	17177 ST 37.8/I	BS 3059 Pt2 BS 3602 Pt1 ERW 360 CAT2	A 49242 A 49245 TS 37C	G 3461 STB 340

Chemical composition and mechanical properties

Material Standard **ASTM-A 210**

Manufacturing Process **Seamless**

Grade	C max	Mn	P max	S max	Si min	min YS KSI [MPA]	min TS KSI [MPA]	El (%)
A1	0.27	0.93 max	0.035	0.035	0.1	37 [255]	60 [415]	30
C	0.35	0.29-1.06	0.035	0.035	0.1	40 [275]	70 [485]	30

Material Standard **ASTM-A 556**

Manufacturing Process **Seamless**

Grade	C max	Mn	P max	S max	Si min	min YS KSI [MPA]	min TS KSI [MPA]	El (%)
A2	0.18	0.27-0.63	0.035	0.035	...	26[180]	47[320]	35
B2	0.27	0.29-0.93	0.035	0.035	0.10	37[260]	60[410]	30
C2	0.30	0.29-1.06	0.035	0.035	0.10	40[280]	70[480]	30

Comparison of International Specifications & Standards

ASTM-A	BS	DIN	NFA	JIS
210 A1	3602 Pt1	17175	A 49215/9	G 3461
A556 B2	ST 430 Cat2	St 45.8/I	T 442 b/F	ST B 410
210 Gr. C	3606	DIN 17175	...	...
A 556 Gr. C2	St 440 Cat.2	17 Mn 4	...	...

Alloy Steel Tubes for Heatexchanger and Boilers

Chemical composition and mechanical properties

Material Standard **ASTM-A 209**

Manufacturing Process **Seamless**

Chemical Requirements

Grade	Element					
	C	Mn	P	S	Si	Mo
T1	0.10-0.20	0.30-0.80	0.025	0.025	0.10-0.50	0.44-0.65
T1a	0.15-0.25	0.30-0.80	0.025	0.025	0.10-0.50	0.44-0.65
T1b	0.14 max	0.30-0.80	0.025	0.025	0.10-0.50	0.44-0.65

Tensile Requirements

Grade	Tensile Strength, min KSI (MPa)	Yield Strength, min (0.2% offset), min, KSI (MPa)	Elongation in 2 in. or 50 mm, (or 4D), min, %
T1	55 [380]	30 [205]	30
T1a	60 [415]	32 [220]	30
T1b	53 [365]	28 [195]	30

Chemical composition and mechanical properties

Material Standard **ASTM-A 199 (94)**

Manufacturing Process **Seamless**

Chemical Requirements

Element	C	Mn	P	S	Si	Cr	Mo	Others
Grade								
T4	0.05 - 0.15	0.30-0.60	0.025	0.025	0.50-1.00	2.15-2.85	0.44-0.65	...
T5	0.15 max	0.30-0.60	0.025	0.025	0.50 max	4.00-6.00	0.45-0.65	...
T9	0.15 max	0.30-0.60	0.025	0.025	0.25-1.00	8.00-10.00	0.90-1.10	...
T11	0.05 - 0.15	0.30-0.60	0.025	0.025	0.50-1.00	1.00-1.50	0.44-0.65	...
T21	0.05 - 0.15	0.30-0.60	0.025	0.025	0.50 max	2.65-3.35	0.80-1.06	...
T22	0.05 - 0.15	0.30-0.60	0.025	0.025	0.50 max	1.90-2.60	0.87-1.13	...
T91	0.08 - 0.12	0.30-0.60	0.020	0.010	0.20-0.50	8.00-9.50	0.85-1.05	*

* Ni 0.40 max; V 0.18-0.25; Cb 0.06-0.10; N 0.03-0.07; Al 0.04 max

Tensile Requirements

Grade	Tensile Strength, min KSI (MPa)	Yield Strength, min (0.2% offset), min, KSI (MPa)	Elongation in 2 in. or 50 mm, (or 4D), min, %
All Grades			
Except T91	60 [415]	25 [170]	30
Grade T91	85 [585]	60 [415]	20

Material Standard: **ASTM A 213**

Manufacturing Process **Seamless**

Grade	C	Si	Mn	P	S	Cr	Mo	V	YS min KSI [MPa]	TS min KSI [MPa]	El (%)
T2	0.10-0.20	0.10-0.30	0.30-0.61	0.025	0.025	0.50-0.81	0.44-0.65	...	30[205]	60[415]	30
T5	0.15 max	0.50 max	0.30-0.60	0.025	0.025	4.00-6.00	0.45-0.65	...	30[205]	60[415]	30
T5b	0.15 max	1.00-2.00	0.30-0.60	0.025	0.025	4.00-6.00	0.45-0.65	...	30[205]	60[415]	30
T5c[1]	0.12 max	0.50 max	0.30-0.60	0.025	0.025	4.00-6.00	0.45-0.65	...	30[205]	60[415]	30
T9	0.15 max	0.25-1.00	0.30-0.60	0.025	0.025	8.00-10.00	0.90-1.10	...	30[205]	60[415]	30
T11	0.05-0.15	0.50-1.00	0.30-0.60	0.025	0.025	1.00-1.50	0.44-0.65	...	30[205]	60[415]	30
T12	0.05-0.15	0.50 max	0.30-0.61	0.025	0.025	0.80-1.25	0.44-0.65	...	32[220]	60[415]	30
T17	0.15-0.25	0.15-0.35	0.30-0.61	0.025	0.025	0.80-1.25	...	0.15	30[205]	60[415]	30
T21	0.05-0.15	0.50 max	0.30-0.60	0.025	0.025	2.65-3.35	0.80-1.06	...	30[205]	60[415]	30
T22	0.05-0.15	0.50 max	0.30-0.60	0.025	0.025	1.90-2.60	0.87-1.13	...	30[205]	60[415]	30
T91[2]	0.08-0.12	0.20-0.50	0.30-0.60	0.020	0.010	8.00-9.50	0.85-1.05	0.18-0.25	60[415]	85[585]	20
T92[3]	0.07-0.13	0.50 max	0.30-0.60	0.020	0.010	8.50-9.50	0.30-0.60	0.15-0.25	64[440]	90[620]	20
18Cr-2Mo[4]	0.025 max	1.00 max	0.30-0.60	0.040	0.030	17.5-19.5	1.75-2.50	...	40[275]	60[415]	20

[1] Grade T5c shall have a titanium content of not less than 4 times the carbon content and not more than 0.70%.

[2] Grade T91 - other elements: Cb 0.06 - 0.10 · N 0.030 - 0.070 · Ni 0.40 max · Al 0.04 max.

[3] Grade T92 - other elements: W 1.50 - 2.00 · Cb 0.04 - 0.09 · B 0.001 - 0.006 · N 0.03 - 0.07 · Ni 0.40 max · Al 0.04 max.

[4] Grade 18Cr-2Mo shall have Ti + Cb = 0.20 + 4(C + N) min, 0.80 max, other elements N max 0.035 · (Ni + Cu) max 1.00.

Chemical composition and mechanical properties

Material Standard **ASTM-A 334**

Manufacturing Processs: **Seamless or Welded**

Chemical Analysis

Grade	C max	Mn	P max	S max	Si	Ni	min YS KSI [MPA]	min TS KSI [MPA]	El (%)
1	0.30	0.40-1.06	0.025	0.025			30 [205]	55 [380]	35
3	0.19	0.31-0.64	0.025	0.025	0.18-0.37	3.18-3.82	35 [240]	65 [450]	30
6	0.30	0.29-1.06	0.025	0.025	0.10 min		35 [240]	60 [415]	30
7	0.19	0.90 max	0.025	0.025	0.13-0.32	2.03-2.57	35 [240]	65 [450]	30
8	0.13	0.90 max	0.025	0.025	0.13-0.32	8.40-9.60	75 [520]	100 [690]	22
9[1]	0.20	0.40-1.06	0.025	0.025		1.60-2.24	46 [315]	63 [435]	28
11[2]	0.10	0.60 max	0.025	0.025	0.35 max	35.0-37.0	35 [240]	65 [450]	18

1 Cu 0.75-1.25

2 Cr 0.50 max · Co 0.50 max · Mo 0.50 max

Comparison of International Specifications & Grades

ASTM	DIN	BS	NFA	JIS
A209 T1/a/b	VD-TÜV	3606	...	G 3462
A161 T1/A335 P1	16Mo5	St 245	...	ST BA 12
A213 T2	...	...	A 49-213	...
			15 CD 2-05	
A 199 T4	...	...	...	...
A 199/213 T5/P5	17176	3604/6	A 49 213	G3462
A 200/A 335	12 Cr Mo 195	ST 625	TU Z 10CD505	ST BA 25
A 199/213 T9/P9	17176	3604	A 49213	...
A 200/A 335	X 12CrMo9.1	ST 629	Z 10CD9	...
A 199 T11/	17176	3059	A49213/5/9	G 3462
A 213 T11/12/P11/12	13CrMo44	3604/6	TU 13 CD 4.04	STBA 22,33
A 200/A335		ST 620-460	TU 10 CD 505	...
A 213 T17	...	...	...	...
A 199/A213/A200/T21	...	...	...	...
A 199/A213 T22/P212	DIN 17176	3059	A 49213/5/9	G 3462
A 200/A335	10 Cr Mo 910	3604/6	TU 10CD 910	STBK 24
		ST 620-490		
A 199/A213 T91/P91	17175	...	A 49213	...
A 200/A 335	X10CrMoYNb 9.1	....	Z 10 CD Nb Y09-01	...
A 213 T92	...	...	...	...
A213 18Cr2Mo	...	...	...	...
A 334	DIN	BS	NFA	JIS
Gr.1	17173	3603	...	G 3464
	TTSt 35 N			STBL 39
Gr.3	10 Ni 14	503LT	49215/30/330	STBL 46
			TU 10 N 14	
Gr.6	DIN 17179	430 LT	TU 42 BT	...
	TST E285			

STANDARD GRADE	BS 2871/PART 3 CZ 110	ASTM B 111 C 68700	DIN 17660/1785 CuZn20Al2	NFA 51102 CuZn22Al2	JIS H3300 C 6870
Cu	76,0 - 78,0	76,0 - 79,0	76,0 - 79,0	76,0 - 79,0	76,0 - 79,0
Al	1,8 - 2,3	1,8 - 2,5	1,8 - 2,3	1,8 - 2,5	1,8 - 2,5
Pb	0,07 max.	0,07 max	0,07 max.	0,07 max.	0,07 max.
Ni			0,1 max.		
Fe	0,06 max.	0,06 max.	0,07 max.	0,06 max.	0,06 max.
Zn	Rem.	Rem.	Rem.	Rem.	Rem.
As	0,02 - 0,06	0,02 - 0,10	0,02 - 0,035	0,02 - 0,06	0,02 - 0,06
P			0,01 max.		
Mg			0,005 max.		
Mn			0,1 max.		
Total Impurities	0,3 max.		Others Total	0,03 max.	
			0,1 max.		
CONDITION	M	061	F39	Annealed (X690)	O
	TA		F34	—	—
	O			—	—
Yield Strength	—	125 min.	150 - 230	—	—
N/mm2	—	—	120 - 180	—	—
	—	—		—	—
Tensile Strength	—	345 min.	390 min.	—	373 min.
N/mm2	—	—	340 min.	—	—
	—	—	—	—	—
Elongation (%)	—	—	45 min.	—	40 min.
	—	—	55 min.	—	—
	—	—		—	—
Hardness Hv5	150 min.	—	—	80 - 130	—
	85 - 110	—	—	—	—
	75 max.	—	—	—	—
Grain Size (mm)	0,050 max.	0,010 - 0,045	0,010 - 0,050	0,010 - 0,045	0,010 - 0,045
	(Condition TA)				

Typical use: Most used copper alloy for heat exchanger tubes application.
Represents the best option for any heat exchanger which is involved with saline water. The addition of arsenic has solved the problem of dezincfication.

Melting Point: 935° C · Hot Working Properties: OK
Density (2° C): 8,33 g/cm3 · Cold Working Properties: Very Good

Weight formula:
Average wall: (OD-WT) x WT x 0,0265 = Kg/m (all sizes in mm)
Minium wall: (OD-WT) x WT x 0,0275 = Kg/m (all sizes in mm)

STANDARD GRADE	BS 2871/PART 3 CZ 111	ASTM B 111 C 44300	DIN 17660/1785 CuZn28Sn1	NFA 51102 CuZn29Sn1	JIS H3300 C 4430
Cu	70,0 - 73,0	70,0 - 73,0	70,0 - 72,5	70,0 - 73,0	70,0 - 73,0
Sn	1,0 - 1,5	0,9 - 1,2	0,9 - 1,3	0,9 - 1,2	0,9 - 1,2
Pb	0,07 max.	0,07 max	0,07 max.	0,07 max.	0,07 max.
Ni			0,1 max.		
Fe	0,06 max.	0,06 max.	0,07 max.	0,06 max.	0,06 max.
Zn	Rem.	Rem.	Rem.	Rem.	Rem.
As	0,02 - 0,06	0,02 - 0,06	0,02 - 0,035	0,02 - 0,06	0,02 - 0,06
P			0,01 max.		
Mn			0,1 max.		
Total Impurities	0,3 max.		Others Total	0,03 max.	
			0,1 max.		
CONDITION	M	061	F36	Annealed (X690)	O
	TA		F32	—	—
	O			—	—
Yield Strength	—	105 min.	140 - 220	—	—
N/mm2	—	—	100 - 170	—	—
	—	—		—	—
Tensile Strength	—	310 min.	360 min.	—	314 min.
N/mm2	—	—	320 min.	—	—
	—	—	—	—	—
Elongation (%)	—	—	45 min.	—	30 min.
	—	—	55 min.	—	—
	—	—		—	—
Hardness Hv5	150 min.	—	—	80 - 120	—
	85 - 105	—	—	—	—
	75 max.	—	—	—	—
Grain Size (mm)	0,050 max.	0,010 - 0,045	0,010 - 0,050	0,010 - 0,045	0,010 - 0,045
	(Condition TA)				

Typical use: The specific copper alloy for application fresh water. Often used for heat exchangers which are involved with operations in petroleum refineries and petrochemical plants.

Melting Point: 935 ° C · Hot Working Properties: OK

Density (20° C): 8,53 g/cm3 · Cold Working Properties: Very Good

Weight formula:

Average wall: (OD-WT) x WT x 0,0270 = Kg/m (all sizes in mm)

Minium wall: (OD-WT) x WT x 0,0281 = Kg/m (all sizes in mm)

STANDARD GRADE	BS 2871/PART 3 CN 102	ASTM B 111 C 70600	DIN 17664/1785 CuNi10Fe1Mn	NFA 51102 CuNi10Fe1Mn	JIS H3300 C 7060
Cu	Rem.	Rem.	Rem.	Rem.	Rem.
Pb	0,01 max.	0,05 max.	0,03 max.	0,05 Sn+Pb max.	0,05 max.
Ni	10,0 - 11,0	9,0 - 11,0	9,0 - 11,0	9,0 - 11,0	9,0 - 11,0
Fe	1,0 - 2,0	1,0 - 1,8	1,0 - 1,8	1,0 - 2,0	1,0 - 1,8
Mn	0,5 - 1,0	1,0 max.	0,5 - 1,0	0,3 - 1,0	0,2 - 1,0
Zn		1,0 max.	0,5 max.	0,5 max.	0,5 max.
S	0,05 max.		0,05 max.	0,02 max.	
C	0,05 max.		0,05 max.	0,05 max.	
Cu+Ni+Fe+Mn					99,5 min.
Total Impurities	0,3 max.		Others Total		
			0,1 max.		
CONDITION	M	061	F29	Annealed (X690)	O
	O	H55		—	—
Yield Strength	—	105 min.	90 - 180	—	—
N/mm2	—	240 min.	—	—	—
Tensile Strength	—	275 min.	290 min.	—	275 min.
N/mm2	—	310 min.		—	—
Elongation (%)	—	—	30 min.	—	30 min.
	—	—	—	—	—
Hardness Hv5	150 min.	—	—	70 - 100	—
	80 - 110	—	—	—	—
Grain Size (mm)	0,050 max.	0,010 - 0,045	0,010 - 0,050	0,010 - 0,045	0,010 - 0,045
	(Condition O)				

Typical use: Used for the working in sea water, mainly for shipbuilding and sea water pipelines, stations, desalination, because of its very good corrosive resistance.

Melting Point: 1150° C · Hot Working Properties: Good

Density (20° C): 8,94 g/cm3 · Cold Working Properties: Good

Weight formula:

Average wall: (OD-WT) x WT x 0,0284 = Kg/m (all sizes in mm)

Minium wall: (OD-WT) x WT x 0,0295 = Kg/m (all sizes in mm)

STANDARD	BS 2871/PART 3	ASTM B 111	DIN 17664/1785	NFA 51102	JIS H3300
GRADE	CN 107	C 71500	CuNi30Mn1Fe	CuNi30Mn1Fe	C 7150
Cu	Rem.	Rem.	Rem.	Rem.	Rem.
Pb	0,01 max.	0,05 max.	0,03 max.	0,05 Sn+Pb max.	0,05 max.
Ni	30,0 - 32,0	29,0 - 33,0	30,0 - 32,0	29,0 - 32,0	29,0 - 33,0
Fe	0,4 - 1,0	0,4 - 1,0	0,4 - 1,0	0,4 - 0,7	0,4 - 0,7
Mn	0,5 - 1,5	1,0 max.	0,5 - 1,5	0,5 - 1,5	0,2 - 1,0
Zn		1,0 max.	0,5 max.	0,5 max.	0,5 max.
S	0,08 max.		0,06 max.	0,02 max.	
C	0,06 max.		0,06 max.	0,06 max.	
Cu+Ni+Fe+Mn					99,5 min.
Total Impurities	0,3 max.		Others Total	0,1 max.	
			0,1 max.		
CONDITION	M	061	F37	Annealed (X690)	O
	O	HR50	—	—	—
Yield Strength	—	125 min.	120 - 220	—	—
N/mm2	—	345 min.	—	—	—
Tensile Strength	—	360 min.	370 min.	—	363 min.
N/mm2	—	495 min.	—	—	—
Elongation (%)	—	—	35 min.	—	30 min.
	—	12 min. (WT≤1,21 mm)	—	—	—
		15 min. (WT›1,21 mm)			
Hardness Hv5	150 min.	—	—	90 - 130	—
	90 - 120	—	—	—	—
Grain Size (mm)	0,050 max.	0,010 - 0,045	0,010 - 0,050	0,010 - 0,045	0,010 - 0,045
	(Condition O)				

Typical use: This alloy has all the characteristics of CuNi 90/10, but also offers excellent corrosion resistance in high velocity sea water. Also the operating temperature is much higher than of CuNi 90/10. Can assure a long service life and reliability.

Melting Point: 1240° C · Hot Working Properties: Good
Density (20° C): 8,94 g/cm3 · Cold Working Properties: Good

Weight formula:
Average wall: (OD-WT) x WT x 0,0284 = Kg/m (all sizes in mm)
Minium wall: (OD-WT) x WT x 0,0295 = Kg/m (all sizes in mm)

STANDARD GRADE	BS 2871/PART 3 CN 108	ASTM B 111 C 71640	DIN 17664/1785 CuNi30Fe2Mn2	NFA 51102 CuNi30Fe2Mn2	JIS H3300 C 7164
Cu	Rem.	Rem.	Rem.	Rem.	Rem.
Pb		0,05 max.	0,02 max.	0,05 Sn+Pb max.	0,05 max.
Ni	29,0 - 32,0	29,0 - 32,0	29,0 - 32,0	29,0 - 32,0	29,0 - 32,0
Fe	1,7 - 2,3	1,7 - 2,3	1,5 - 2,5	1,5 - 2,0	1,7 - 2,3
Mn	1,5 - 2,5	1,5 - 2,5	1,5 - 2,5	1,5 - 2,0	1,5 - 2,5
Zn		1,0 max.	0,5 max.	0,5 max.	0,5 max.
S			0,06 max.	0,02 max.	
C			0,05 max.	0,06 max.	
Cu+Ni+Fe+Mn					min. 99,5
Total Impurities	0,3 max.		0,3 max.	0,1 max.	
CONDITION	M	061	F42	Annealed (X690)	O
	O	HR50	—		—
Yield Strength	—	170 min.	150 - 260	—	—
N/mm2	—	400 min.	—	—	—
Tensile Strength	—	435 min.	420 min.	—	430 min.
N/mm2	—	560 min.	—	—	—
Elongation (%)	—	—	30 min.	—	30 min.
	—	—	—	—	—
Hardness Hv5	150 min.	—	—	90 - 130	—
	90 - 120	—	—	—	—
Grain Size (mm)	0,050 max.	0,010 - 0,045	0,010 - 0,050	0,010 - 0,045	0,010 - 0,045
	(Condition O)				

Typical use: Has the most resistance against impingement attack and corrosion by suspended solids of all copper based alloys which are used for heat exchanger tube applications. This alloy is preferred for desalination plants.

Melting Point: 1240°C · Hot Working Properties: Good
Density (20°C): 8,94 g/cm3 · Cold Working Properties: Good

Weight formula:
Average wall: (OD-WT) x WT x 0,0284 = Kg/m (all sizes in mm)
Minium wall: (OD-WT) x WT x 0,0295 = Kg/m (all sizes in mm)

TPS - SHUTDOWN SERVICE



TPS has increased the department for Refinery Shutdown- and Emergency Services.

This department is specialized in the supply of Heat-Exchanger and Condenser Tubes in

- **Carbon Steel**
- **Alloy Steel**
- **Non Ferrous Metals**
- **Stainless Steel**
- **Nickel Alloys and**
- **Titanium**

for urgent requirements and emergency purposes.

The material is either available ex stock for delivery within hours or from special new production within a very short lead time.

”Just in time deliveries” is not only an idiom. It is proved that TPS has served a lot of refinieries with quick and excellent deliveries. The result is a tremendous saving in costs and time for the endusers.

A further advantage is that the refinery or the petrochemical plant does not have to keep its own stock for shutdowns and maintenance periods.

As mentioned above, deliveries ex stock can be made within 24 hours during the week and within 48 hours during the weekend.

We have experience with this type of business and therefore we now offer our worldwide ”Shutdown Service”.

Furthermore we offer a complete service with yearly contracts and estimated quantities for all kinds of Heat-Exchanger tubes used in your plant.

In case you have special questions please do not hesitate to contact usby phone, by fax or by e-mail:

TPS TECHNITUBE® RÖHRENWERKE GMBH

Shutdown Service

TPS-Technitube Röhrenwerke GmbH
Julius-Saxler-Straße 7 · Industriegebiet · D-54550 Daun, Germany
P.O. BOX 509 · D-54541 Daun, Germany

PHONE: (49) 6592 7120 · FAX: (49) 6592 1305
E-MAIL: service@TPSD.de
WEB-SITE: www.TPS-Technitube.de

Stock Sizes and Grades

Tube OD AD	Thickness WS	ASTM A 179	ST 35.8/I DIN 17175	ASTM A 199/ A 213 T 5	ASTM A 199/ A 213 T 9	ASTM A 214	ASTM B 111C 687 BS 2871/3 CZ 110	ASTM B 111 C 443 BS 2871/3 CZ 111	ASTM B 111 C 706 BS 2871/3 CN 102	ASTM B 111 C 715 BS 2871/3 CN 107	Tube OD AD in mm	Thickness WS in mm
5/8″	18 SWG						X	X			15,88	1,219
5/8″	18 BWG						X	X			15,88	1,245
5/8″	16 BWG						X	X			15,88	1,651
3/4″	18 BWG						X	X	X (1)	X (1)	19,05	1,245
3/4″	16 SWG						X	X	X (1)	X (1)	19,05	1,626
3/4″	16 BWG	X	X				X	X	X (1)	X (1)	19,05	1,651
3/4″	14 SWG					X	X	X	X (1)	X (1)	19,05	2,032
3/4″	14 BWG	X	X	X			X	X	X (1)	X (1)	19,05	2,108
3/4″	12 BWG	X	X				X	X			19,05	2,769
1″ 14	SWG						X	X			25,40	2,032
1″ 14	BWG	X	X				X	X			25,40	2,108
1″ 13	BWG						X	X			25,40	2,413
1″ 12	BWG	X	X	X	X		X	X			25,40	2,769
1″ 10	BWG	X	X								25,40	3,404
20 mm	2,00 mm	X (1)	X (1)								20,00	2,00
25 mm	2,00 mm	X (1)	X (1)								25,00	2,00
25 mm	2,50 mm	X (1))	X (1)								25,00	2,50

(1) Average wall thickness

Tubes are certified as follows:

Carbon Steel:	ASTM/ASME/DIN/BS/NFA
Alloy Steel:	ASTM/ASME
Aluminium Brass:	ASTM/ASME/BS
Admiralty Brass:	ASTM/ASME/BS
Copper-Nickel:	ASTM/ASME/BS
Stainless Steel:	ASTM/ASME/DIN/NFA/NACE/EN
Longitudinal Fin Tubes:	DIN

New Stock Items

Different Stainless Steel Grades in lengths up to 19.600 mm available ex Stock.

Stock Sizes and Grades

Tube OD AD	Thickness WS	ASTM A 213 TP 304	ASTM A 213 TP 304L	ASTM A 213 TP 316	ASTM A 213 TP 316L	ASTM A 213 TP 321	ASTM A 213 TP 316 Ti	Tube OD AD in mm	Thickness WS in mm
5/8"	18 SWG							15,88	1,219
5/8"	18 BWG							15,88	1,245
5/8"	16 BWG							15,88	1,651
3/4"	18 BWG							19,05	1,245
3/4"	16 SWG	X	X	X	X	X		19,05	1,626
3/4"	16 BWG	X	X	X	X	X		19,05	1,651
3/4"	14 SWG	X	X	X	X			19,05	2,032
3/4"	14 BWG	X	X	X	X			19,05	2,108
3/4"	12 BWG							19,05	2,769
1"	16 SWG			X	X			25,40	1,626
1"	16 BWG			X	X			25,40	1,626
1"	14 SWG	X	X	X	X			25,40	2,032
1"	14 BWG	X	X	X	X			25,40	2,108
1"	13 BWG							25,40	2,413
1"	12 BWG							25,40	2,769
1"	10 BWG							25,40	3,404
20 mm	2,00 mm			X(1)	X(1)			20,00	2,00
25 mm	2,00 mm			X(1)	X(1)	X(1)	X(1)	25,00	2,00

(1) Average wall thickness

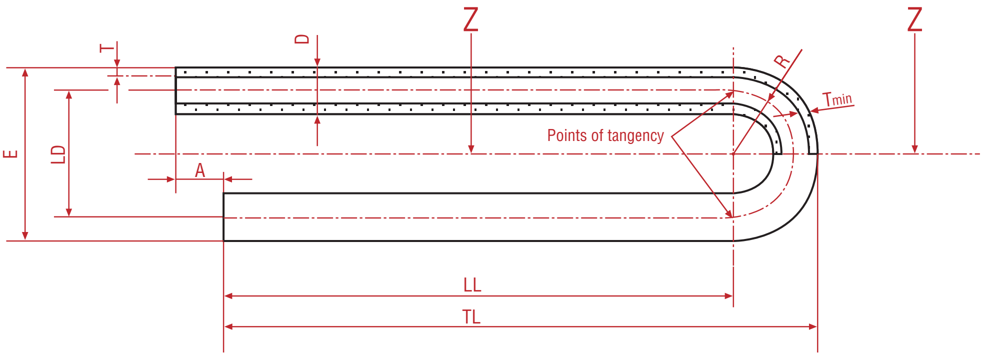
Definition

U-Tubes as per this technical delivery standard are bend hairpin tubes which are usually used in heat exchangers.

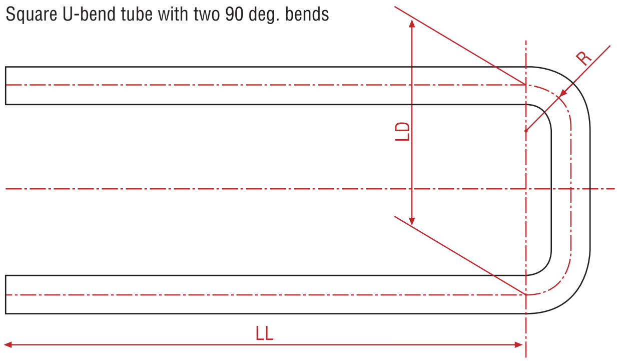
Scope

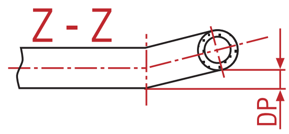
This technical delivery standard refers to U-bend tubes with radii from 1,5 D. Tolerances for smaller radii have to be agreed with the customer.

Hairpin U-bend tube with one 180 deg. bend



Square U-bend tube with two 90 deg. bends





section Z - Z

The meaning of measurements and symbols:

A	LEG LENGTH DIFFERENCE
E	(2R + D) 2X RADIUS PLUS OUTSIDE DIAMETER
D	NOMINAL OUTSIDE DIAMETER
Dmax.	MAX. OUTSIDE DIAMETER
Dmin.	MIN. OUTSIDE DIAMETER
LD	LEG LENGTH DISTANCE MEASURED FROM POINTS OF TANGENCY
LL	LEG LENGTH
TL	TOTAL LENGTH
R	CENTERLINE BEND RADIUS
Rmin.	MIN. RADIUS
T	WALL THICKNESS
Tmin.	MIN. WALL THICKNESS IN OUTSIDE BENDING AREA
SW	SMALLEST WALL THICKNESS OF STRAIGHT TUBE
O	OVALITY
DP	DEVIATION FROM PLANE OF BEND
Z	Section

• Wall thinning of bending area

Wall thinning refers to the minimum wall thickness of straight tube
Radius ≥ 1,5 D: max. 17 % wall thinning

$$T_{min.} \geq \frac{SW\,(2R + D)}{2\,(R + D)}$$

• Flattening on bend (TEMA R.C.B. 2.31 only)

Flattening does not exceed 10 % of nominal diameter

• Tolerance for leg spacing

(2 R - D) = 1,5 mm

• Tolerance on ovality

Allowable deviation from ovality in %

$\leq 4\,D \quad \frac{D}{5\,R}\ 100 = \%$

› 4 D ≤ 5%

The deviation O of the ovality will be calculated as follows:

$$O = 200\ \frac{D_{max.} - D_{min.}}{D_{max.} + D_{min.}} = \%$$

• Tolerance on straight leg length

straight leg	≤	6000 mm	-0 / +3 mm
straight leg	›	6000 mm - 9000mm	-0 / +4 mm
straight leg	›	9000 mm	-0 / +5 mm

• Difference in leg length

leg length	≤	5000 mm	-0 / +3 mm
leg length	›	5000 mm	-0 / +5 mm

• Tolerance on total length

The total length specifies the length of the external bend tangent line to the end of straight leg.

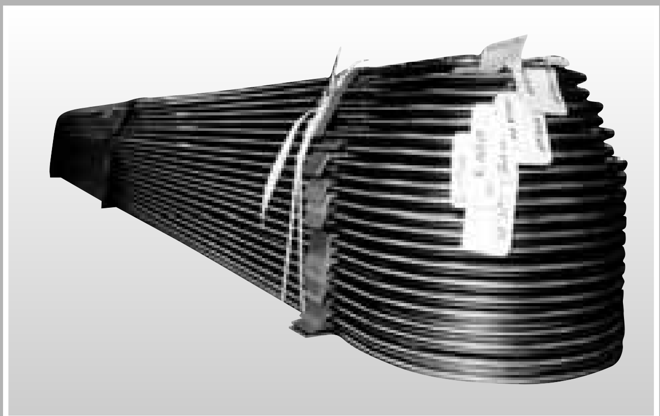
TL = LL + 0,5 D + R

Tolerances	≤ 6000 mm	-0/+5 mm
	› 6000 mm	-0/+8 mm

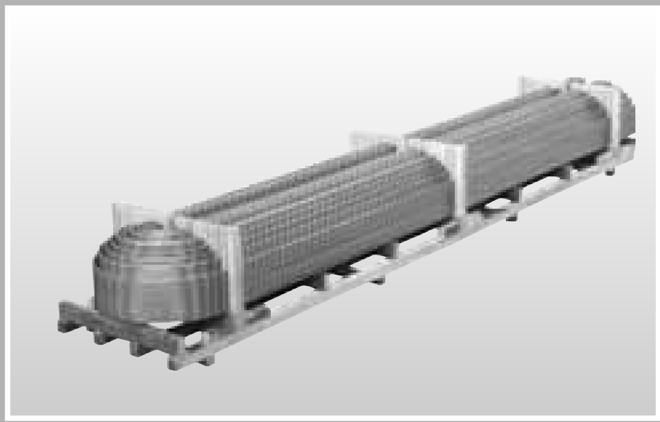
• Deviation from plane of bend

DP max 1/16" = 1,5 mm

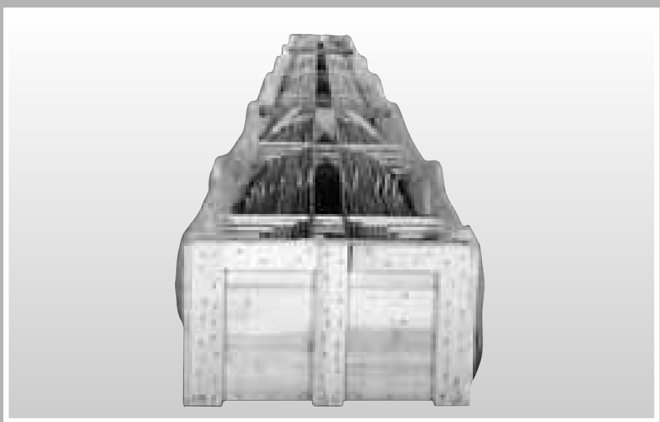
Types of packing



Packing in layers, each radius marked with labels



Packing in wooden “combs” on pallets



Packing in layers and seaworthy wooden boxes



Packing on pallets protected with sheet plastic.

7 Excellent reasons to buy U-Tubes from TPS

1 Saving time and money due to In-House Bending

Tube production and bending in one facility. No need to transport tubes from manufacturer to the bending shop and from there to the fabricator. This eliminates also the additional transportation costs for the long length straight tubing.

Furthermore there is a considerable saving of time due to In-house bending, because bending process can be started immediately after the first straight tubes have been rolled.

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2 3-Year Warranty*

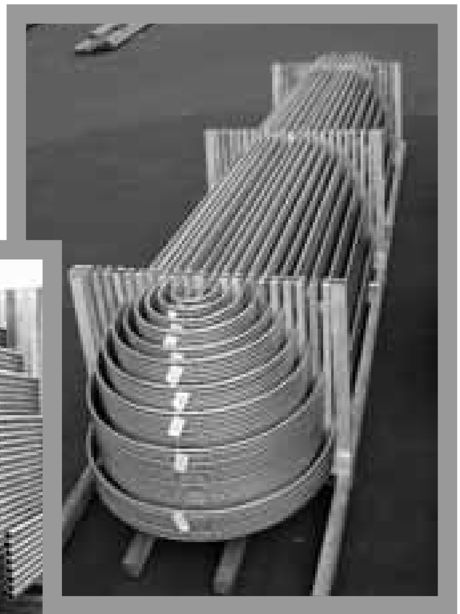
Our warranty period is above the legal rules and covers 36 months for the tubes and the tube bends made at TPS in accordance to the specifications.

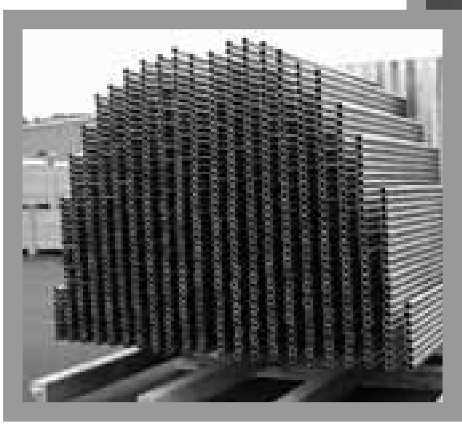
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3 User friendly packing methods

The pre-sorted packing methods in rows or layers and sorted by radius will allow quick and easy removal of the tubes either from top row by row or from the box end by layers

You will save space, time and money.





* In line with our general terms and conditions of sale we guarantee defect free materials and good workmanship

7 Excellent reasons to buy U-Tubes from TPS

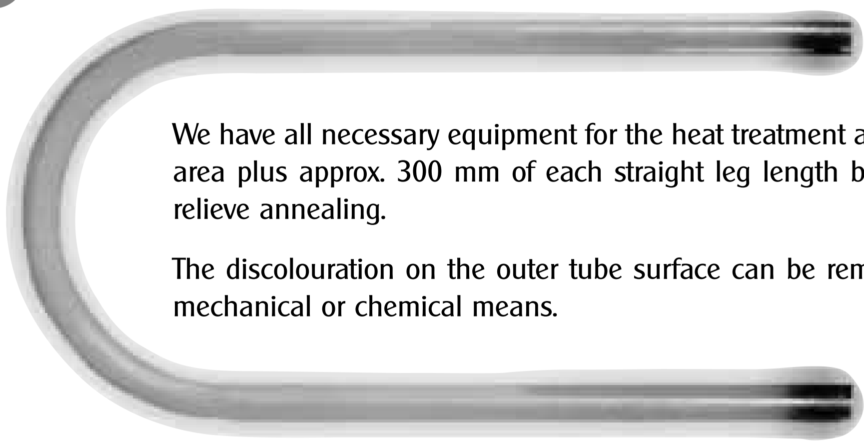
4 Spares

We keep spare tubes of longest developed length in our factory during the time of assembling the tube bundle. This spares can be bent with correct radius and be delivered against actual freight rate.

5 Cutting Allowances

Have you ever noticed how other suppliers charge you for the cutting allowance? TPS only charges the actual quantity shown on the bending schedule.

6 Heat Treatment of Bending Zone



We have all necessary equipment for the heat treatment after bending of bent area plus approx. 300 mm of each straight leg length by solution- or stress relieve annealing.

The discolouration on the outer tube surface can be removed on request by mechanical or chemical means.

7 Quality Assurance

The U-tubes supplied by TPS are subject to the same strict quality assurance requirements as the straight tubes and we grant full warranty for the bending area also.





Electric resistance heat treatment with controlled temperature by an automatic Infra-Red-Camera



Pre-sorted packing by radii



Ready for packing into wooden boxes

OD \ WT	SWG M/W mm 25,00 0,508	SWG A/W mm 25,00 0,508	BWG M/W mm 25,00 0,507	BWG A/W mm 25,00 0,507	SWG M/W mm 23,00 0,610	SWG A/W mm 23,00 0,610	BWG M/W mm 23,00 0,634	BWG A/W mm 23,00 0,634	SWG M/W mm 22,00 0,711	SWG A/W mm 22,00 0,711	BWG M/W mm 22,00 0,711	BWG A/W mm 22,00 0,711	SWG M/W mm 21,00 0,813	SWG A/W mm 21,00 0,813	BWG M/W mm 21,00 0,812	BWG A/W mm 21,00 0,812	SWG M/W mm 20,00 0,914	SWG A/W mm 20,00 0,914	BWG M/W mm 20,00 0,889
3/16″ 4.76 mm	0,058	0,053	0,058	0,053	0,068	0,062	0,075	0,065	0,077	0,071	0,077	0,071	0,086	0,079	0,086	0,079	0,094	0,087	0,092
1/4″ 6.35 mm	0,080	0,073	0,080	0,073	0,095	0,086	0,098	0,089	0,108	0,099	0,108	0,099	0,121	0,111	0,121	0,111	0,133	0,123	0,131
3/8″ 9.53 mm	0,125	0,113	0,125	0,113	0,148	0,134	0,153	0,139	0,170	0,155	0,170	0,155	0,192	0,175	0,192	0,175	0,213	0,194	0,208
1/2″ 12.7mm	0,169	0,153	0,169	0,152	0,201	0,182	0,208	0,189	0,232	0,210	0,232	0,210	0,262	0,238	0,262	0,238	0,292	0,266	0,285
5/8″ 15,88 mm																0,372	0,337	0,362	
3/4″ 19,05 mm																0,451	0,409	0,440	
7/8″ 22,2 mm																			
1″ 25.4 mm																			
1 1/16″ 26,99 mm																			
1 1/8″ 28,58 mm																			
1 1/4″ 31.75 mm																			
1 1/2″ 38,1 mm																			
1 3/4″ 44.45 mm																			
2″ 50.8 mm																			
2 1/4″ 57.15 mm																			
2 1/2″ 63.5 mm																			
2 3/4″ 69.85 mm																			
3″ 76,2 mm																			

OD \ WT	SWG M/W mm 13,00 2,337	SWG A/W mm 13,00 2,337	BWG M/W mm 13,00 2,413	BWG A/W mm 13,00 2,413	SWG M/W mm 12,00 2,642	SWG A/W mm 12,00 2,642	BWG M/W mm 12,00 2,768	BWG A/W mm 12,00 2,768	SWG M/W mm 11,00 2,947	SWG A/W mm 11,00 2,947	BWG M/W mm 11,00 3,048	BWG A/W mm 11,00 3,048	SWG M/W mm 10,00 3,251	SWG A/W mm 10,00 3,251	BWG M/W mm 10,00 3,403	BWG A/W mm 10,00 3,403	SWG M/W mm 9,00 3,658	SWG A/W mm 9,00 3,658	BWG M/W mm 9,00 3,760
1/2″ 12,7 mm	0,647	0,597	0,662	0,612	0,706	0,655	0,729	0,678											
5/8″ 15,88 mm	0,850	0,780	0,872	0,801	0,936	0,862	0,970	0,895											
3/4″ 19,05 mm	1,053	0,962	1,082	0,990	1,165	1,069	1,210	1,111											
7/8″ 22,2 mm	1,255	1,146	1,290	1,179	1,394	1,276	1,450	1,328	1,523	1,401	1,523	1,441	1,657	1,521		1,579			
1″ 25,4 mm	1,459	1,329	1,502	1,368	1,624	1,483	1,691	1,545	1,780	1,632	1,835	1,680	1,940	1,776	2,014	1,846	2,137	1,961	
1 1/16″ 26,99 mm	1,561	1,421	1,607	1,463	1,742	1,586	1,814	1,654	1,915	1,747	1,972	1,800	2,083	1,903	2,165	1,980	2,298	2,105	
1 1/8″ 28,58 mm	1,660	1,512	1,710	1,557	1,854	1,690	1,933	1,763	2,041	1,862	2,101	1,919	2,223	2,030	2,310	2,112	2,455	2,248	
1 1/4″ 31,75 mm	1,865	1,695	1,921	1,764	2,082	1,897	2,171	1,979	2,290	2,093	2,365	2,157	2,505	2,285	2,607	2,379	2,772	2,534	2,836
1 1/2″ 38,1 mm	2,268	2,061	2,341	2,124	2,541	2,310	2,656	2,412	2,801	2,555	2,894	2,635	3,071	2,794	3,199	2,912	3,408	3,107	3,489
1 3/4″ 44,45 mm	2,676	2,427	2,759	2,502	3,003	2,724	3,137	2,845	3,311	3,015	3,423	3,112	3,636	3,303	3,791	3,445	4,044	3,680	4,142
2″ 50,8 mm	3,084	2,793	3,180	2,879	3,461	3,138	3,619	3,279	3,822	3,478	3,953	3,589	4,201	3,812	4,380	3,978	4,680	4,253	4,795
2 1/4″ 57,15 mm	3,490	3,159	3,596	3,256	3,920	3,551	4,098	3,712	4,332	3,939	4,482	4,066	4,765	4,321	4,975	4,510	4,332	3,939	5,450
2 1/2″ 63,5 mm	3,896	3,525	4,020	3,635	4,379	3,965	4,582	4,146	4,843	4,401	5,011	4,544	5,332	4,830	5,567	5,044	5,951	5,398	6,101
2″ 50.8 mm	4,302	3,891	4,436	4,013	4,838	4,379	5,060	4,580	5,353	4,862	5,541	5,021	5,897	5,339	6,159	5,576	6,587	5,971	6,757
2 3/4″ 69,85 mm	4,708	4,257	4,859	4,391	5,297	4,792	5,545	5,013	5,864	5,323	6,070	5,499	6,462	5,848	6,751	6,109	7,223	6,544	7,411
3″ 76,2 mm	5,115	4,623	5,278	4,768	5,757	5,206	6,023	5,446	6,394	5,785	6,599	5,976	7,027	6,356	7,343	6,642	7,858	7,116	8,064
3 1/4″ 82,55 mm	5,521	4,989	5,698	5,145	6,216	5,620	6,504	5,879	6,885	6,246	7,129	6,453	7,593	6,866	7,935	7,175	8,494	7,689	8,713
3 1/2″ 95,25 mm					6,675	6,034	6,985	6,313	7,395	6,708	7,657	6,930	8,158	7,375	8,526	7,708	9,130	8,262	9,370
4″ 101,6 mm																			

SWG A/W mm	SWG M/W mm	BWG A/W mm	BWG M/W mm	SWG A/W mm	SWG M/W mm	BWG A/W mm	BWG M/W mm	SWG A/W mm	SWG M/W mm	BWG A/W mm	BWG M/W mm	SWG A/W mm	SWG M/W mm	BWG A/W mm	BWG M/W mm	SWG A/W mm	SWG M/W mm	BWG A/W mm	WT / OD
19 1,016	19 1,086	19 1,086	18 1,219	18 1,219	18 1,244	18 1,244	16 1,626	16 1,626	16 1,651	16 1,651	15 1,829	15 1,829	15 1,828	15 1,828	14 2,032	14 2,032	14 2,108	14 2,108	
0,134	0,153	0,141	0,167	0,154	0,169	0,157	0,202	0,189	0,204	0,191	0,216	0,204	0,216	0,204					1/4" 6.35 mm
0,293	0,342	0,311	0,379	0,345	0,385	0,351	0,485	0,444	0,491	0,450	0,534	0,490	0,534	0,490	0,581	0,536	0,599	0,551	1/2" 12.7mm
0,452	0,530	0,481	0,590	0,536	0,601	0,545	0,766	0,698	0,779	0,709	0,852	0,777	0,852	0,777	0,936	0,853	0,964	0,881	3/4" 19,05 mm
			0,802	0,726	0,817	0,714	1,048	0,953	1,068	0,970	1,170	1,063	1,169	1,063	1,290	1,171	1,331	1,211	1" 25.4 mm
							1,193	1,081	1,210	1,097	1,331	1,207	1,329	1,206	1,466	1,330	1,514	1,376	1 1/8" 28,58 mm
							1,615	1,462	1,637	1,483	1,805	1,636	1,805	1,636	1,998	1,807	2,064	1,871	1 1/2" 38,1 mm
															2,704	2,444	2,796	2,531	2" 50.8 mm
															3,407	3,080	3,529	3,192	2 1/2" 63.5 mm
															4,121	3,716	4,262	3,852	3" 76,2 mm

SWG A/W mm	SWG M/W mm	BWG A/W mm	BWG M/W mm	SWG A/W mm	SWG M/W mm	BWG A/W mm	WT / OD
8 40,64	8 4,191	8 4,191	7 4,471	7 4,471	7 4,572	7 4,572	
							5/8" 15,88 mm
							7/8" 22,2 mm
							1 1/16" 26,99 mm
2,775	3,108	2,848					1 1/4" 31,75 mm
4,047	4,564	4,161	4,833	4,408	4,928	4,496	1 3/4" 44,45 mm
5,320	6,022	5,473	6,387	5,808	6,517	5,928	2 1/4" 57,15 mm
6,593	7,479	6,786	7,941	7,208	8,106	7,36	2" 50.8 mm
7,866	8,933	8,098	9,496	8,608	9,696	8,792	3" 76,2 mm
9,138	10,393	9,411	11,050	10,009	11,285	10,223	3 1/2" 95,25 mm

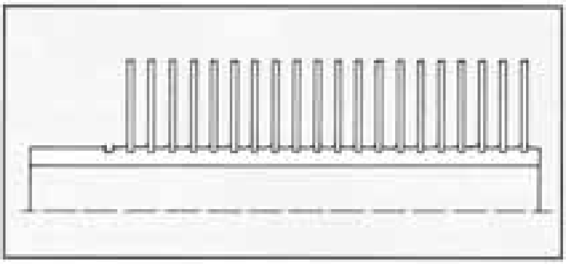
Weights in kg/m

Conversion Factors	Carbon Steel	
Aluminium Brass (Alloy 687)	x	1.057
Admiralty Brass (Alloy 443)	x	1.082
Cu/Ni 90/10 (Alloy 706)	x	1.133
Cu/Ni 70/30 (Alloy 715)	x	1.133
Stainless steel:	x	1.015
UNS N04400	x	1.125
UNS N06600	x	1.073
UNS N08800	x	1.013
UNS N08810	x	1.013
UNS N08825	x	1.037
UNS N0N10665	x	1.174
UNS N0N06455	x	1.131

M/W minimum wall · A/W average wall

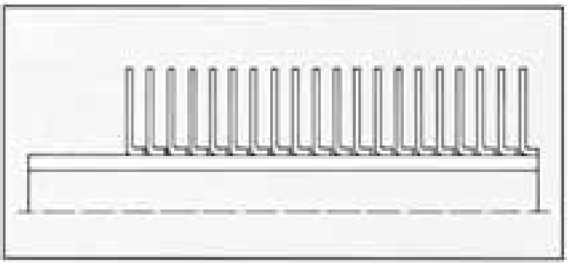
TECHNIFIN TYPE „G"

The fin strip is wound into a mechanically produced groove and tightened by backfilling of the base material under pressure. Groove depth 0,4 mm. Advantages: High fin stability, excellent heat transfer, high operating temperature.



TECHNIFIN TYPE „L", „KL", „DL"

The fin strip is shaped into a „L" and wound onto the tube surface under tension. Advantages: Core tube extensively protected against corrosion by the fin foot, finning of very thin-walled tubes possible.

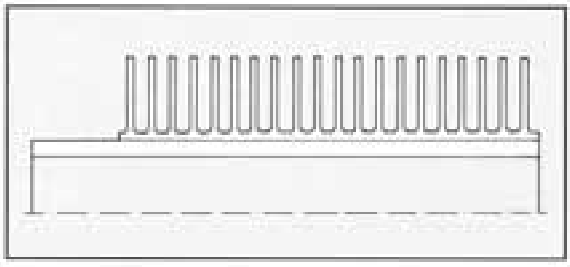


TECHNIFIN TYPE „HY"

A smooth core tube is inserted into an aluminium tube and then fins are extrudes out of the aluminium tube. Advantages: Bond ot outer and inner tube removes the risk of loss of contact due to thermal stress, fins are more rigid, also available as serrated type TECHNIFIN „HYS" see below.

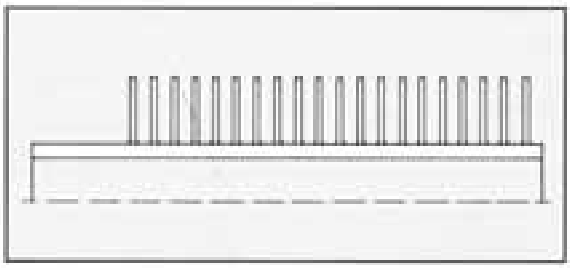
TECHNIFIN TYPE „HYS"

As per type „HY", but fins are serrated. Advantages: Higher heat transfer coefficient, for same pressure drop compared with „HY" fin.



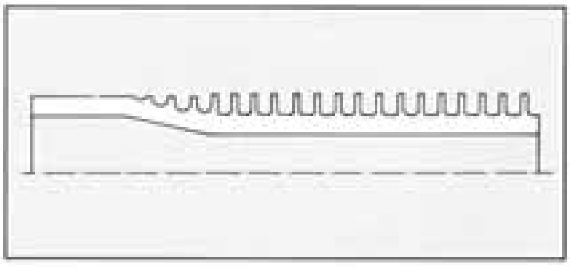
TECHNIFIN TYPE „I"

The fin strip is wound onto the base tube. Typical fin material: steel.



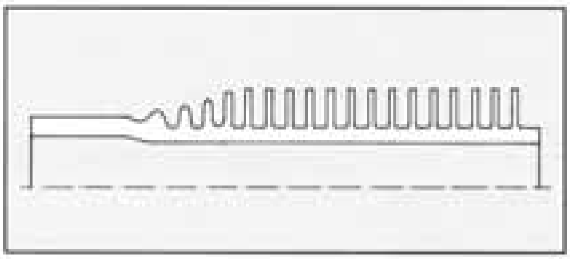
TECHNIFIN TYPE „N"

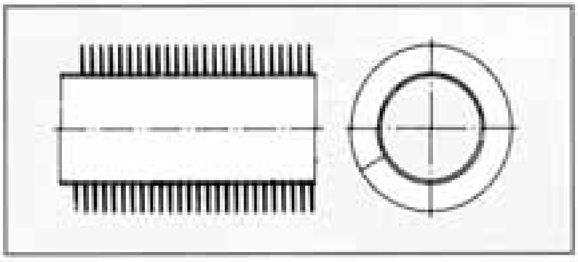
The fins are rolled out of the wall of the plain tube. Tube and fin are consisting of one piece. Advantages: Excellent heattransfer, good bending properties, wide range of material can be used.



TECHNIFIN TYPE „M"

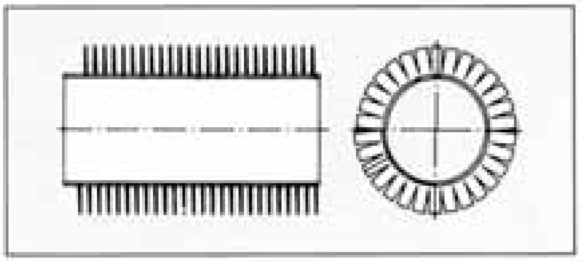
Manufacturing and adavantages as described for type „N" but with higher fins.





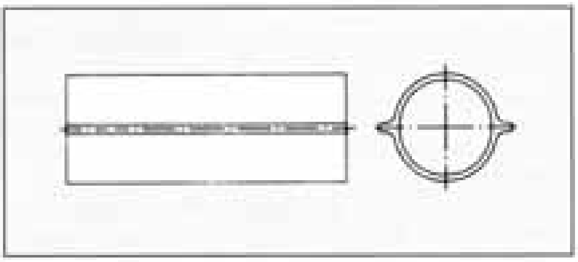
TECHNIFIN TYPE „WO“

The fin strip is wound spirally onto the tube and welded continuously to the tube along the spiral root. Advantages: Strong connection between fin and base tube, prevents loosening of fin because of heat stress, oxidization, corrosion etc., use at very high temperatures possible.



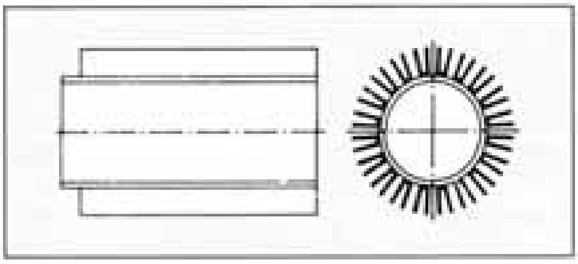
TECHNIFIN TYPE „WOS“

As per type „WO“, but fins are serrated. Advantages: Higher heat transfer coefficient. For the same pressure drop compared with „WO“ fin.



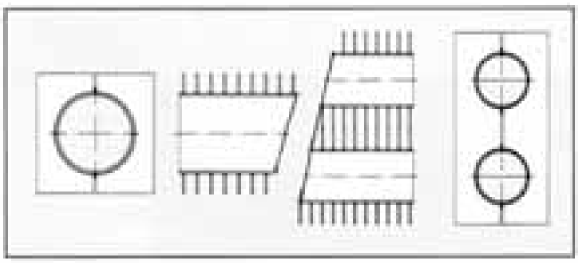
TECHNIFIN TYPE „LFS“

Extruded or drawn fin tube , seamless with two longitudinal opposite fins. Used in boiler wall constructions.



TECHNIFIN TYPE „LFW“

I/L or U fins welded longitudinally onto the base tube.

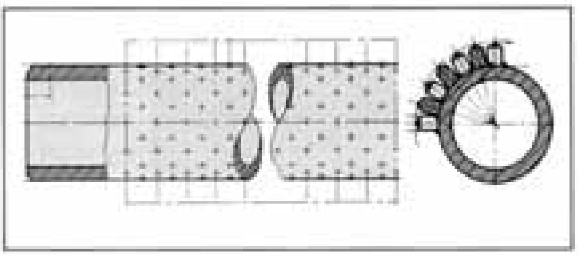


TECHNIFIN TYPE „S“

Square fins are welded onto a round base tube.

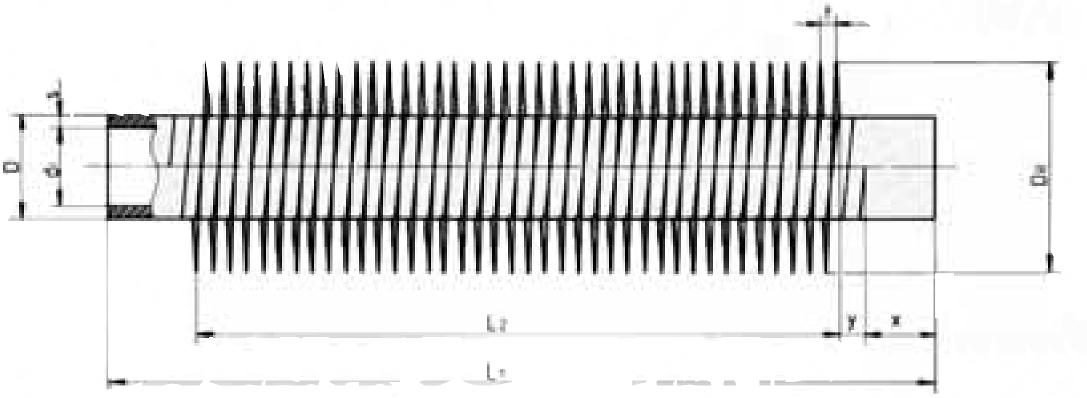
TECHNIFIN TYPE „Double S“

Square fins are welded onto two round base tubes.



TECHNISTUD

Steel studs are welded by a special process onto the base tube.



L1 max. = 12 000 mm
L2 max. = L1 -2y
Y max. = 4 x t

Fin Thickness = 0,3 - 0,4 mm
x = acc. to clients specification

Fa = Outer Tube Surface Area incl. Surface Area of Fins
Fi = Interior Tube Surface Area per Meter (m2/m)
FZR = Uncovered Tube Area between the fins

MATERIAL COMBINATIONS

Core Tube

Carbon steels (ASTM A 179/ A 214, St 35.8,ect.), low-alloy steels, stainless steels, copper-nickel alloys, aluminium bronze, copper, nickel-alloys (Alloy 400, etc.), bimetal

Fins

Aluminium / Steel / Galvanized Steel

FIELDS OF APPLICATION

· the petroleum, chemical and petrochemical process industries
· natural gas treatment
· the steel industry: blast furnace and converter systems
· power generation: steam turbine exhaust condensing
  - contact condensing with cooling of circulating condensate
  - fossil and nuclear power plants
· air conditioning (freon, ammonia, propane)
· incineration of household refuse
· compressor coolers, ect.

MANUFACTURING PROCESS

The manufacturing tool is made up of 2 non-cutting plates set at 90° to the axis of the base tube.
The first plate effects a groove for metal spinning. The second directs the ribbon in the groove and sets the fin foot in the groove through pressure on the metal displaced for the groove.
A similar plate made of tungsten carbure allows us to manufacture G finned tubes with base tubes made of austenitic steel or exotic alloys.

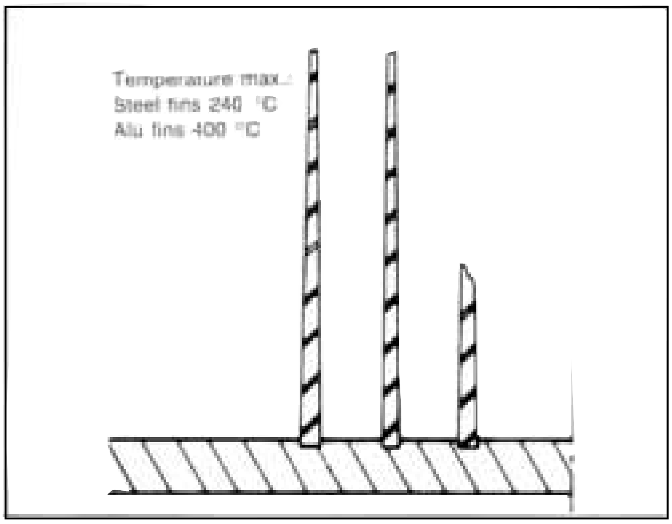
ADVANTAGES

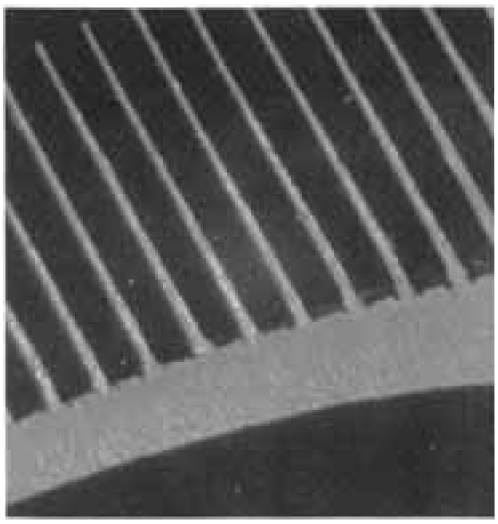
1) Thermal

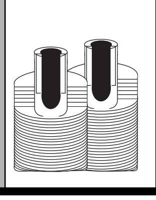
The fin/tube wall contact is constant because of the setting and makes it possible to use a wall temperature of up to 400° C.

2) Mechanical

The fin is set throughout its length and consequently does not unwind even when partially uprooted.





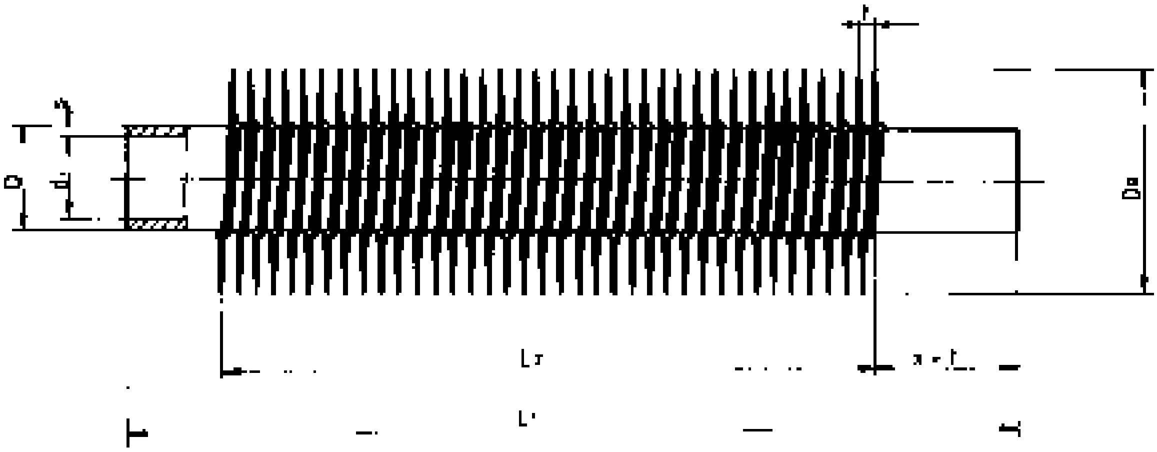


D = 25,4 mm* DR = 50,8 mm + DR = 57 mm

* on request, other core tube dimensions available

ORDER-No.	s mm	di mm	Fins/in. t	Fa m*2*/m	Fa/Fi	Weight Kg/m	FZR m*2*/m
TECHNIFIN® G 1.2.51- 5			5	0,678	10,09	1,51	0,0234
TECHNIFIN® G 1.2.51- 6			6	0,798	11,87	1,58	0,0230
TECHNIFIN® G 1.2.51- 7			7	0,918	13,65	1,65	0,0226
TECHNIFIN® G 1.2.51- 8	2	21,4	8	1,037	15,43	1,72	0,0222
TECHNIFIN® G 1.2.51- 9			9	1,157	17,21	1,79	0,0218
TECHNIFIN® G 1.2.51-10			10	1,277	18,99	1,85	0,0214
TECHNIFIN® G 1.2.51-11			11	1,396	20,77	1,94	0,0210
TECHNIFIN® G 1.2,5.51- 5			5	0,678	10,58	1,76	0,0234
TECHNIFIN® G 1.2,5.51- 6	2,11		6	0,798	12,45	1,83	0,0230
TECHNIFIN® G 1.2,5.51- 7	(14 BWG)		7	0,918	14,32	1,90	0,0226
TECHNIFIN® G 1.2,5.51- 8	Min. Wall	(20,4)	8	1,037	16,19	1,98	0,0222
TECHNIFIN® G 1.2,5.51- 9	-2,5		9	1,157	18,05	2,05	0,0218
TECHNIFIN® G 1.2,5.51-10			10	1,277	19,92	2,11	0,0214
TECHNIFIN® G 1.2,5.51-11			11	1,396	21,79	2,19	0,0210
TECHNIFIN® G 1.3.51- 5			5	0,678	11,13	2,01	0,0234
TECHNIFIN® G 1.3.51- 6	2,77		6	0,798	13,09	2,08	0,0230
TECHNIFIN® G 1.3.51- 7	(12 BWG)		7	0,918	15,06	2,15	0,0226
TECHNIFIN® G 1.3.51- 8	Min. Wall	(19,4)	8	1,037	17,02	2,22	0,0222
TECHNIFIN® G 1.3.51- 9	-3,0		9	1,157	18,98	2,29	0,0218
TECHNIFIN® G 1.3.51-10			10	1,277	20,95	2,36	0,0214
TECHNIFIN® G 1.3.51-11			11	1,396	22,91	2,44	0,0210
TECHNIFIN® G 1.2.57- 5			5	0,885	13,16	1,65	0,0291
TECHNIFIN® G 1.2.57- 6			6	1,046	15,56	1,73	0,0286
TECHNIFIN® G 1.2.57- 7			7	1,207	17,95	1,82	0,0281
TECHNIFIN® G 1.2.57- 8	2	21,4	8	1,368	20,35	1,92	0,0276
TECHNIFIN® G 1.2.57- 9			9	1,529	22,74	2,01	0,0271
TECHNIFIN® G 1.2.57-10			10	1,690	25,14	2,11	0,0266
TECHNIFIN® G 1.2.57-11			11	1,851	27,53	2,20	0,0261
TECHNIFIN® G 1.2,5.57- 5			5	0,885	13,81	1,89	0,0291
TECHNIFIN® G 1.2,5.57- 6	2,11		6	1,046	16,32	1,99	0,0286
TECHNIFIN® G 1.2,5.57- 7	(14 BWG)		7	1,207	18,83	2,08	0,0281
TECHNIFIN® G 1.2,5.57- 8	Min. Wall	(20,4)	8	1,368	21,35	2,18	0,0276
TECHNIFIN® G 1.2,5.57- 9	-2,5		9	1,529	23,86	2,27	0,0271
TECHNIFIN® G 1.2,5.57- 10			10	1,690	26,37	2,37	0,0266
TECHNIFIN® G 1.2,5.57- 11			11	1,851	28,88	2,46	0,0261
TECHNIFIN® G 1.3.57- 5			5	0,885	14,42	2,14	0,0291
TECHNIFIN® G 1.3.57- 6	2,77		6	1,046	17,16	2,23	0,0286
TECHNIFIN® G 1.3.57- 7	(12 BWG)		7	1,207	19,80	2,33	0,0281
TECHNIFIN® G 1.3.57- 8	Min. Wall	(19,4)	8	1,368	22,45	2,42	0,0276
TECHNIFIN® G 1.3.57- 9	-3,0		9	1,529	25,09	2,52	0,0271
TECHNIFIN® G 1.3.57-10			10	1,690	27,73	2,61	0,0266
TECHNIFIN® G 1.3.57-11			11	1,851	30,37	2,71	0,0261

Given weights are for steel tubes with Aluminium fins. Weight calculation for steel fins: Kg/m ≈ weight of table + 0,1827 x fins per inch.



$L_{1\ max.}$ = 12 000 mm
$L_{2\ max.}$ = L1 -2t

Fin Thickness = 0,3 - 0,4 mm
x = acc. to clients specification

Fa = Outer Tube Surface Area incl. Surface Area of Fins
Fi = Interior Tube Surface Area per Meter (m2/m)
F_{ZR} = Uncovered Tube Area between the fins

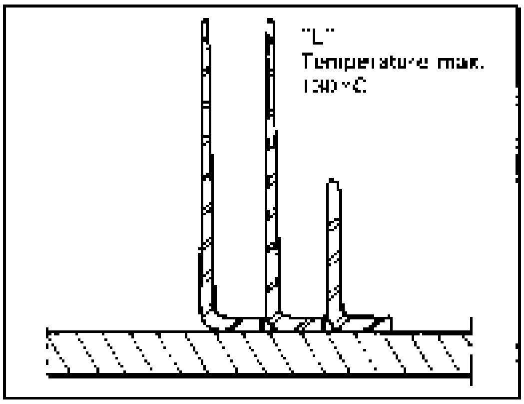
MATERIAL COMBINATIONS

Core Tube

Carbon steels (ASTM A 179/ A 214, St 35.8,ect.), low-alloy steels, stainless steels, copper-nickel alloys, aluminium bronze, copper, nickel-alloys (Alloy 400, ext.), bimetal

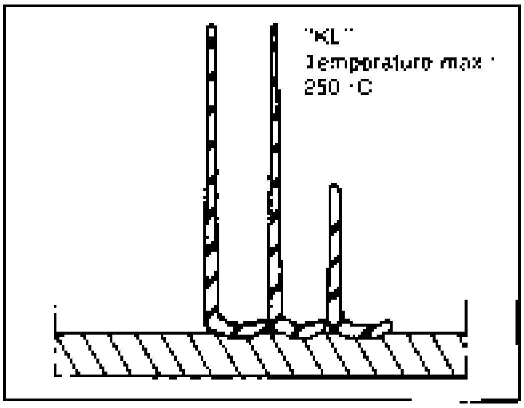
Fins

Aluminium



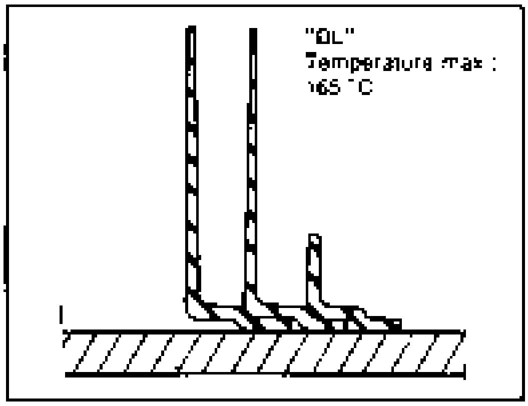
FIELDS OF APPLICATION

- the petroleum, chemical and petrochemical process industries
- natural gas treatment
- the steel industry: blast furnace and converter systems
- power generation: steam turbine exhaust condensing
  - contact condensing with cooling of circulating condensate
  - fossil and nuclear power plants
- air conditioning (freon, ammonia, propane)
- incineration of household refuse
- compressor coolers, ect.



MANUFACTURING PROCESS

The manufacturing strip is folded to from an L shape and then wound around the base tube. The feet of the fins are joined together and cover the whole of the finned surface. Both lends are clamped down to avoid unrolling through damage.



ADVANTAGES

Economic

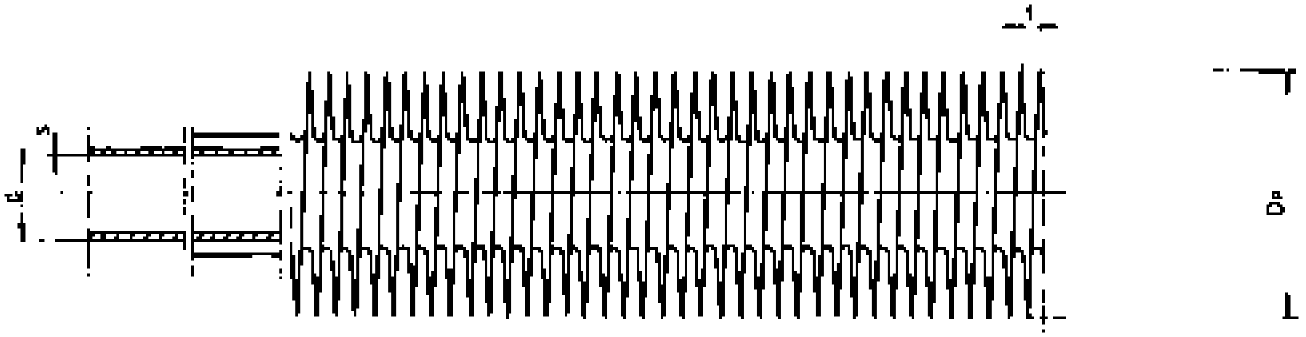
This method of manufacturing enables us to place the finning on a very thin-walled tube with is particularly desirable when using noble alloys (titanium, stainless, copper, nickel).
The tube can withstand a temperature of up to 130°C without the risk of atmospheric corrosion or thermal stress.

D = 25,4 mm* DR = 50,8mm + DR = 57 mm

* on request, other core tube dimensions available

ORDER-No.	S mm	di mm	Fins/in. t	Fa m²/m	Fa/Fi	Weight Kg/m	FRZ m²/m
TECHNIFIN® L 1.2.51.-5			5	0,678	10,09	1,51	0,0229
TECHNIFIN® L 1.2.51-6			6	0,798	11,87	1,58	0,0224
TECHNIFIN® L 1.2.51-7			7	0,918	13,65	1,65	0,0219
TECHNIFIN® L 1.2.51-8	2	21,4	8	1,037	15,43	1,72	0,0214
TECHNIFIN® L 1.2.51-9			9	1,157	17,21	1,79	0,0209
TECHNIFIN® L 1.2.51-10			10	1,277	18,99	1,85	0,0204
TECHNIFIN® L 1.2.51-11			11	1,396	20,77	1,94	0,0199
TECHNIFIN® L 1.2,5.51-5			5	0,678	10,58	1,76	0,0229
TECHNIFIN® L 1.2,5.51-6	2,11		6	0,798	12,45	1,83	0,0224
TECHNIFIN® L 1.2,5.51-7	(14 BWG)		7	0,918	14,32	1,90	0,0219
TECHNIFIN® L 1.2,5.51-8	Min. Wall	(20,4)	8	1,037	16,19	1,98	0,0214
TECHNIFIN® L 1.2,5.51-9	-2,5		9	1,157	18,05	2,05	0,0209
TECHNIFIN® L 1.2,5.51-10			10	1,277	19,92	2,11	0,0204
TECHNIFIN® L 1.2,5.51-11			11	1,396	21,79	2,19	0,0199
TECHNIFIN® L 1.3.51-5			5	0,678	11,13	2,01	0,0229
TECHNIFIN® L 1.3.51-6	2,77		6	0,798	13,09	2,08	0,0224
TECHNIFIN® L 1.3.51-7	(12 BWG)		7	0,918	15,06	2,15	0,0219
TECHNIFIN® L 1.3.51-8	Min. Wall	(19,4)	8	1,037	17,02	2,22	0,0214
TECHNIFIN® L 1.3.51-9	-3,0		9	1,157	18,98	2,29	0,0209
TECHNIFIN® L 1.3.51-10			10	1,277	20,95	2,36	0,0204
TECHNIFIN® L 1.3.51-11			11	1,396	22,91	2,44	0,0199
TECHNIFIN® L 1.2.57-5			5	0,885	13,16	1,65	0,0286
TECHNIFIN® L 1.2.57-6			6	1,046	15,56	1,73	0,0280
TECHNIFIN® L 1.2.57-7			7	1,207	17,95	1,82	0,0274
TECHNIFIN® L 1.2.57-8	2	21,4	8	1,368	20,35	1,92	0,0268
TECHNIFIN® L 1.2.57-9			9	1,529	22,74	2,01	0,0262
TECHNIFIN® L 1.2.57-10			10	1,690	25,14	2,11	0,0256
TECHNIFIN® L 1.2.57-11			11	1,851	27,53	2,20	0,0250
TECHNIFIN® L 1.2,5.57-5			5	0,885	13,81	1,89	0,0286
TECHNIFIN® L 1.2,5.57-6	2,11		6	1,046	16,32	1,99	0,0280
TECHNIFIN® L 1.2,5.57-7	(14BWG)		7	1,207	18,83	2,08	0,0274
TECHNIFIN® L 1.2,5.57-8	Min.Wall	(20,4)	8	1,368	21,35	2,18	0,0268
TECHNIFIN® L 1.2,5.57-9	-2,5		9	1,529	23,86	2,27	0,0262
TECHNIFIN® L 1.2,5.57-10			10	1,690	26,37	2,37	0,0256
TECHNIFIN® L 1.2,5.57-11			11	1,851	28,88	2,46	0,0250
TECHNIFIN® L 1.3.57-5			5	0,885	14,42	2,14	0,0286
TECHNIFIN® L 1.3.57-6	2,77		6	1,046	17,16	2,23	0,0280
TECHNIFIN® L 1.3.57-7	(12BWG)		7	1,207	19,80	2,33	0,0274
TECHNIFIN® L 1.3.57-8	Min.Wal	(19,4)	8	1,368	22,45	2,42	0,0268
TECHNIFIN® L 1.3.57-9	-3,0		9	1,529	25,09	2,52	0,0262
TECHNIFIN® L 1.3.57-10			10	1,690	27,73	2,61	0,0256
TECHNIFIN® L 1.3.57-11			11	1,851	30,37	2,71	0,0250

Given weights are for steel tubes with Aluminium fins. Weight calculation for steel fins: Kg/m weight of table + 0,1827 x fins per inch.



$L_{1max.}$ = 12 000 mm
$L_{2max.}$ = acc. to clients specification

Fin Thickness = 0,4 mm

Fa = Outer Tube Surface Area incl. Surface Area of Fins
Fi = Interior Tube Surface Area per Meter (m2/m)
F_{RZ} = Uncovered Tube Area between the fins

MATERIAL COMBINATIONS

Core Tube

Carbon steels (ASTM A179 / A 214, St 35.8, ect.), low-alloy steels, stainless steels, copper-nickel alloys, aluminium bronze, copper, nickel-alloys, as well as exotic grades.
Core tubes with extremely thin wall of above stated materials can be applied.

Exterior Tube & Fins

Generally Aluminium

FIELDS OF APPLICATION

· the petroleum, chemical and petrochemical industries
· natural gas treatment
· the steel industry: blast furnace and converter cooling systems
· power generation: steam turbine exhaust condensing
  - contact condensing with cooling of circulating condensate
  - fossil and nuclear power plants
· air conditioning (freon, ammonia, propane)
· incineration of household refuse
· compressor coolers, ect.

MANUFACTURING PROCESS

A polished and deoiled base tube is set in an aluminium sleeve. The whole goes through the fin-machine wich consists of three spindles set at 120° each on bearing a stack of plates. These plates, stacked in from and diameter first build the fin, then bond the outer and inner tubes together.

In certain cases (high air speed) the fins are serrated after fin process so as to increase the air coefficient.

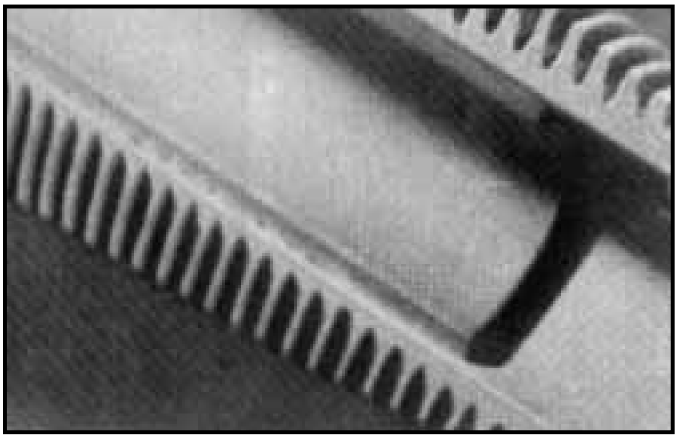
ADVANTAGES

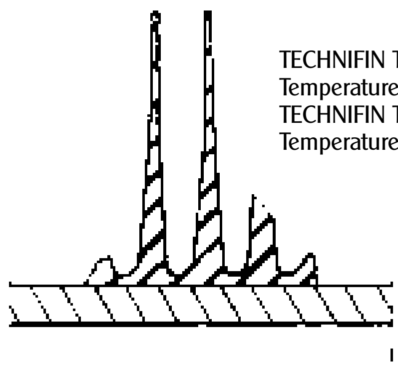
1) Thermal

The bonding of the outer and inner tubes removes the risk of loss of contact with the aluminium due to thermal stress.
Maximum operating temperature: 250°C.
The transfer coeffcient remains steady.
Additionally as the outer sleeve is continuous no electrolytic couple is created.

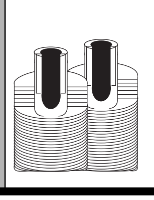
2) Mechanical

The fins are more rigid and stand the handling shocks better, compared to types „G“ an „L“.





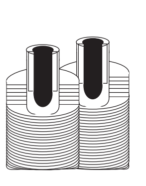
TECHNIFIN Type „HY“
Temperature max.: 300°C
TECHNIFIN Type „HYS“
Temperature max.: 300°C

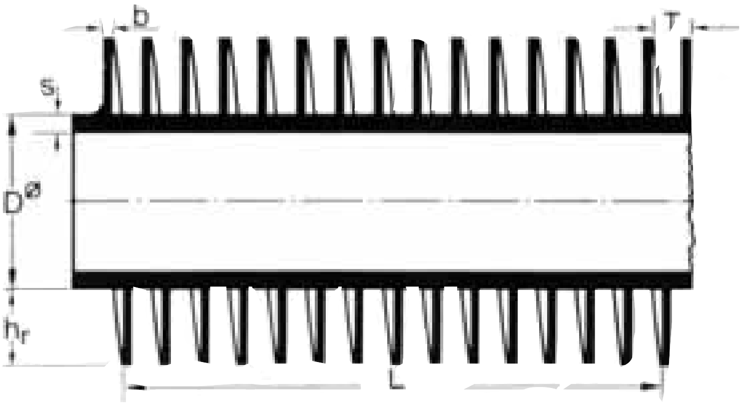


D = 25,4 mm* DR = 50,8 mm + DR = 57 mm
*on request, other core tube dimensions available

ORDER-No.	S mm	di mm	Fins/in. t	Fa m^2/m	Fa/Fi	Weight Kg/m	FZR m^2/m
TECHNIFIN® HY 1.1.51-8			8	0,991	13,48	1,49	0,0204
TECHNIFIN® HY 1.1.51-9	1,0	23,4	9	1,105	15,02	1,49	0,0200
TECHNIFIN® HY 1.1.51-10			10	1,218	16,56	1,49	0,0197
TECHNIFIN® HY 1.1,2.51-8			8	0,991	13,72	1,68	0,0204
TECHNIFIN® HY 1.1,2.51-9	1,2	23,0	9	1,105	15,28	1,68	0,0200
TECHNIFIN® HY 1.1,2.51-10			10	1,218	16,85	1,68	0,0197
TECHNIFIN® HY 1.1,5.51-8			8	0,991	14,09	1,85	0,0204
TECHNIFIN® HY 1.1,5.51-9	1,5	22,4	9	1,105	15,69	1,85	0,0200
TECHNIFIN® HY 1.1,5.51-10			10	1,218	17,30	1,85	0,0197
TECHNIFIN® HY 1.2.51-8			8	0,991	14,74	2,12	0,0204
TECHNIFIN® HY 1.2.51-9	2,0	21,4	9	1,105	16,43	2,12	0,0200
TECHNIFIN® HY 1.2.51-10			10	1,218	18,11	2,12	0,0197
TECHNIFIN® HY 1.2,5.51-8			8	0,991	15,47	2,38	0,0204
TECHNIFIN® HY 1.2,5.51-9	2,5	20,4	9	1,105	17,23	2,38	0,0200
TECHHIFIN® HY 1.2,5.51-10			10	1,218	19,00	2,38	0,0197
TECHNIFIN® HY 1.3.51-8			8	0,991	16,26	2,62	0,0204
TECHNIFIN® HY 1.3.51-9	3,0	19,4	9	1,105	18,12	2,62	0,0200
TECHNIFIN® HY 1.3.51-10			10	1,218	19,98	2,62	0,0197
TECHNIFIN® HY 1.1.57-8			8	1,330	18,10	1,69	0,0259
TECHNIFIN® HY 1.1.57-9	1,0	23,4	9	1,486	20,23	1,69	0,0254
TECHNIFIN® HY 1.1.57-10			10	1,642	22,33	1,69	0,0249
TECHNIFIN® HY 1.1,2.57-8			8	1,330	18,41	1,88	0,0259
TECHNIFIN® HY 1.1,2.57-9	1,2	23,0	9	1,486	20,58	1,88	0,0254
TECHNIFIN® HY 1.1,2.57-10			10	1,642	22,72	1,88	0,0249
TECHNIFIN® HY 1.1,5.57-8			8	1,330	18,91	2,05	0,0259
TECHNIFIN® HY 1.1,5.57-9	1,5	22,4	9	1,486	21,11	2,05	0,0254
TECHNIFIN® HY 1.1,5.57-10			10	1,642	23,33	2,05	0,0249
TECHNIFIN® HY 1.2.57-8			8	1,330	19,79	2,32	0,0259
TECHNIFIN® HY 1.2.57-9	2,0	21,4	9	1,486	22,12	2,32	0,0254
TECHINFIN® HY 1.2.57-10			10	1,642	24,41	2,32	0,0249
TECHNIFIN® HY 1.2,5.57-8			8	1,330	20,76	2,58	0,0259
TECHNIFIN® HY 1.2,5.57-9	2,5	20,4	9	1,486	23,20	2,58	0,0254
TECHNIFIN® HY 1.2,5.57-10			10	1,642	25,61	2,58	0,0249
TECHNIFIN® HY 1.3.57-8			8	1,330	21,83	2,82	0,0259
TECHNIFIN® HY 1.3.57-9	3,0	19,4	9	1,486	24,40	2,82	0,0254
TECHNIFIN® HY 1.3.57-10			10	1,642	26,93	2,82	0,0249

Given weights are for steel tubes with Aluminium fins. Weight calculation for steel fins: Kg/m weight of table + 0,1827 x fins per inch.





Size Range

Base tube size: 6-219.1 (other sizes upon request)
Fins: 50-500 fins/meter
Fin thickness: 0.4-1.5 mm

Fin quantity and size depend on diameter of base tube. In case of deviation against the sizes of the opposite page, please ask us.

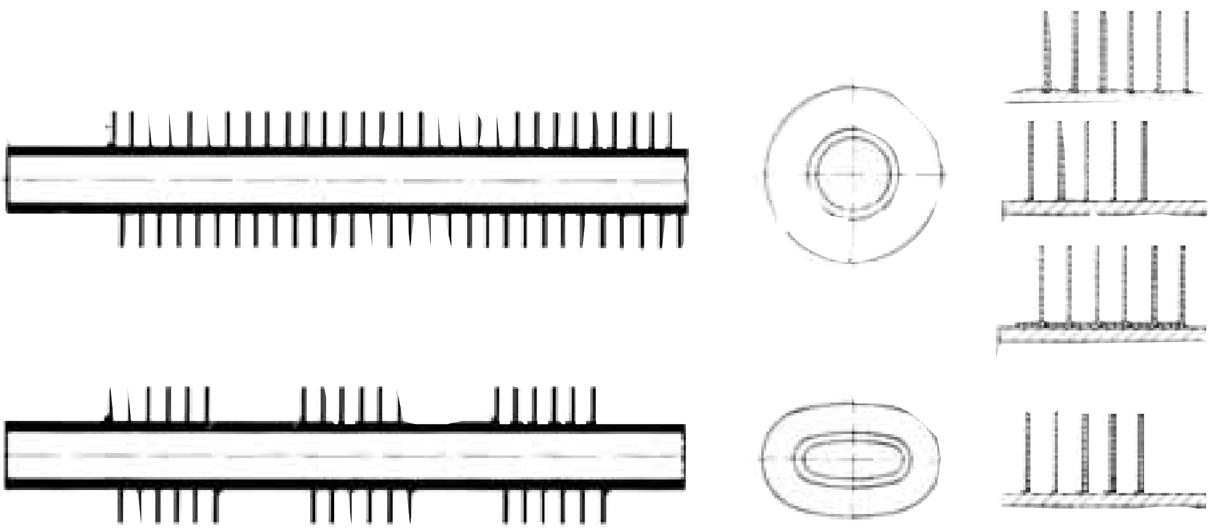
Tolerances:	Fin height:	+/- 1mm
	Fins/meter:	+/- 2%/meter
	Plain ends:	+/- 5mm

Manufacturing Process

Fins are spirally wound on a steel base tube, without welding/soldering.
Execution: black, galvanized and for special applications Stainless Steel, Copper, Brass, and/or Aluminium.
Ends can be bevelled, bended or spot welded upon request.

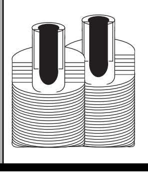
Fields of application

Climatic Industry, Cooling
Heating, Drying



TECHNIFIN® Type “I”

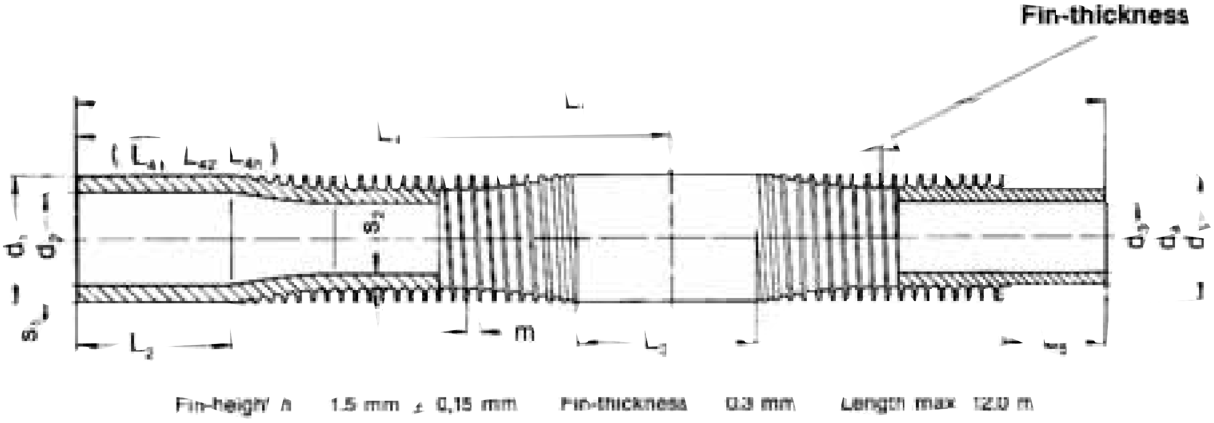
Standard Size Range



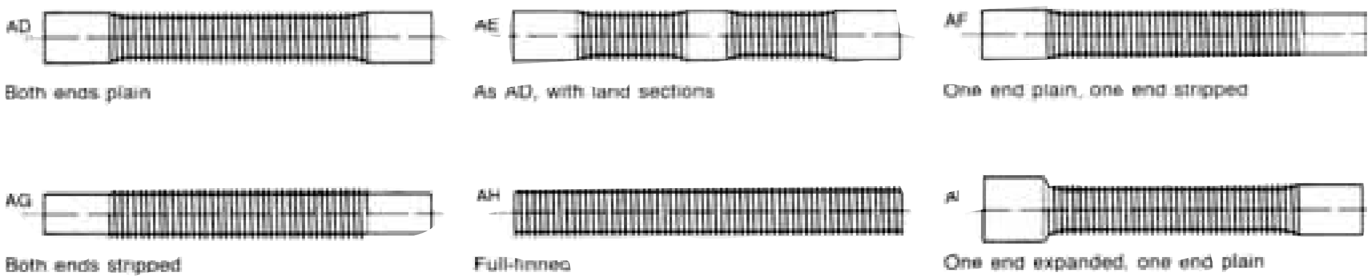
Tube OD	Tube Wall	Strip Size	Fins Diam.	Fins/m	Surface Area	Weight kg/m
10,2	1,6	10 x 0,4	30	115	0,22	0,60
				200	0,37	0,83
				320	0,57	1,09
15	1,5	10 x 0,4	35	150	0,34	0,91
				250	0,54	1,16
				350	0,74	1,47
17,2	1,8	10 x 0,4	37,2	80	0,22	0,91
				150	0,37	1,11
				225	0,52	1,32
				300	0,68	1,54
				330	0,74	1,62
17,2	1,8	14 x 0,4	45,2	85	0,35	1,10
				110	0,44	1,21
				210	0,80	1,70
				250	0,95	1,88
18	2	10 x 0,4	38	80	0,22	1,02
				150	0,37	1,22
				200	0,48	1,37
				250	0,59	1,51
				300	0,70	1,65
18	2	14 x 0,4	46	81	0,35	1,18
				150	0,60	1,52
				220	0,85	1,88
				290	1,11	2,21
20	2	10 x 0,4	48	80	0,24	1,13
				120	0,33	1,25
				180	0,47	1,44
				250	0,62	1,65
				300	0,74	1,80
20	2	14 x 0,4	48	100	0,44	1,40
				150	0,63	1,65
				200	0,82	1,91
				250	1,01	2,17
21,3	2	10 x 0,4	41,3	100	0,30	1,27
				130	0,37	1,37
				185	0,49	1,54
				210	0,55	1,62
				250	0,64	1,75
				300	0,76	1,94
21,3	2	14 x 0,4	49,3	98	0,45	1,49
				150	0,65	1,78
				200	0,84	2,05
				250	1,04	2,32
21,3	2	20 x 0,5	61,3	65	0,51	1,70
				100	0,75	2,17
				135	1,00	2,50
25	2	14 x 0,4	53	100	0,49	1,69
				150	0,70	2,09
				200	0,91	2,26
				250	1,12	2,55
26,9	2,3	14 x 0,4	54,9	100	0,51	1,99
				160	0,77	2,34
				210	0,99	2,64
26,9	2,3	20 x 0,5	66,9	60	0,53	2,15
				100	0,83	2,65
				140	1,14	3,15
30	2,6	20 x 0,5	70	100	0,88	3,08
				150	1,28	3,73
				200	1,67	4,38
33,7	2,6	20 x 0,5	73,7	40	0,43	2,56
				110	1,02	3,52
				157	1,41	4,32
				220	1,93	5,03
33,7	2,6	26 x 1	85,7	40	0,60	3,64
				67	0,95	4,75
				110	1,48	6,51

OTHER SIZES CAN BE OFFERED UPON REQUEST!

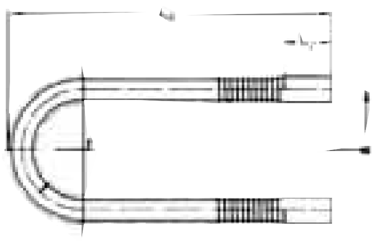
Tube OD	Tube Wall	Strip Size	Fins Diam.	Fins/m	Surface Area	Weight kg/m
38	2,6	26 x 1	90	40	0,64	4,01
				80	1,17	5,73
				123	1,74	7,58
38	2,6	30 x 1	98	48	0,91	4,88
				83	1,49	6,77
				128	2,24	9,20
38	2,6	35 x 1	108	48	1,14	5,62
				88	2,00	8,40
				120	2,68	10,62
44,5	2,6	26 x 1	96,5	50	0,84	5,00
				85	1,34	6,61
				120	1,84	8,23
44,5	2,6	30 x 1	104,5	44	0,91	5,22
				72	1,41	6,84
				120	2,26	9,61
44,5	2,6	35 x 1	114,5	50	1,27	6,38
				70	1,72	7,85
				105	2,51	10,42
48,3	2,6	26 x 1	100,3	40	0,74	4,86
				85	1,40	7,02
				155	2,43	10,37
48,3	2,6	30 x 1	108,3	62,5	1,29	6,69
				91	1,82	8,40
				115	2,26	9,81
48,3	2,6	35 x 1	118,3	50	1,32	6,75
				70	1,78	8,27
				90	2,25	9,79
57	2,9	30 x 1	117	67	1,50	8,21
				92	2,00	9,83
				117	2,50	11,44
				140	2,95	12,93
57	2,9	35 x 1	127	52	1,48	8,14
				72	1,98	9,78
				92	2,49	11,42
				112	2,99	13,04
57	2,9	50 x 1	157	33	1,64	8,66
				40	1,95	9,67
				52,5	2,50	11,47
76,1	2,9	30 x 1	136,1	63	1,69	10,01
				77	2,01	11,05
				98	2,49	12,62
				110	2,77	13,52
76,1	2,9	35 x 1	146,1	44	1,50	8,58
				61	2,00	11,30
				78	2,50	12,60
				96	3,00	14,30
76,1	2,9	50 x 1	176,1	36	2,03	11,00
				45	2,48	12,56
				56	3,02	14,33
88,9	3,2	35 x 1	158,9	55	2,00	12,43
				71	2,51	14,06
				87	3,01	15,70
88,9	3,2	50 x 1	188,9	35	2,14	12,88
				50	2,95	15,49
				65	3,75	18,09
108	3,6	35 x 1	178	47	1,99	14,71
				62	2,52	16,42
				76	3,01	18,03
108	3,6	40 x 1	188	51	2,50	16,37
				69	3,27	18,86
				86	3,99	21,22
108	3,6	50 x 1	208	30	2,10	15,06
				45	2,98	17,93
				62	3,98	21,18



d_1	d_5	d_4	d_4 stripped	S_1	S_2	L_2	L_3	L_4	L_5	L_1
+0 -0,2	+0 -0,2	± 0,15	+0 -0,2	± 10%	± 10%	+5 -0	+5 -0	± 3 mm	+1 -0	< 2000 mm + 2 mm 2000 - 8000 mm + 1 ‰ max. 5 mm > 8000 mm + 0,7 ‰



U-Bent Fin Tubes



Surfaces

can be pickled or tinned upon request.

Certificate:

DIN 50049/3.1 B or
DIN 50049/3.1 C

Materials

Please refer to the „Alloy table for fintubes TECHNIFIN Type N and M“

Fields of application

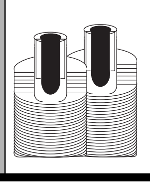
Chemical-, Petrochemical- and Petroleum Industries. Used in condensers, oilcoolers, waterheaters, heatexchangers, evaporators and heat-recoverers.

Manufacturing process

The fins are rolled out of the wall of the plain tube by use of a pass roller. Tube and fin consist of one piece.

Advantages

Economical solution of heatexchange problems of media with different heat conduction abilities or different current conditions. High chemical-, thermal- and mechanical resistance, suitable for rough working conditions.



16 FINS/ INCH   FIN PITCH M = 1.59

Plain section					Finned section							
Code No. TECHNIFIN „N"	External Ø Inch	External Ø d1 mm	Int. d2 mm	Wall-thickn. S1 mm	Root dia. Ø Int. d3 mm	Root dia. Ø Ext. d4 mm	Ext. Ø d5 mm	Wall-thickn. BWG	Wall-thickn. S2 mm	Ext. surface Aa m²/m	Radio outs. to ins. Aa/Ai	Weight G Cu ca. kg/m
16.1/2.19	1/2"	12,70	9,80	1,45	7,50	9,50	12,50	19	1,00	0,08	3,6	0,38
16.1/2.18			9,40	1,65	7,00			18	1,25		3,8	0,43
16.5/8.17	5/8"	15,90	11,90	2,00	9,70	12,70	15,70	17	1,50	0,11	3,6	0,65
16.5/8.16			11,60	2,15	9,40			16	1,65		3,7	0,69
16.3/4.17	3/4"	19,00	15,00	2,00	12,80	15,80	18,80	17	1,50	0,13	3,3	0,83
16.3/4.16			14,70	2,15	12,50			16	1,65		3,4	0,88
16.3/4.14			14,00	2,50	11,60			14	2,10		3,6	1,03
16.7/8.17	7/8"	22,20	18,20	2,00	16,00	19,00	22,00	17	1,50	0,16	3,1	1,00
16.7/8.16			17,90	2,15	15,70			16	1,65		3,2	1,06
16.7/8.14			17,20	2,50	14,80			14	2,10		3,3	1,25
16.1.17	1"	25,40	21,40	2,00	19,20	22,20	25,20	17	1,50	0,18	3,0	1,18
16.1.16			21,10	2,15	18,90			16	1,65		3,1	1,25
16.1.14			20,40	2,50	18,00			14	2,10		3,2	1,49

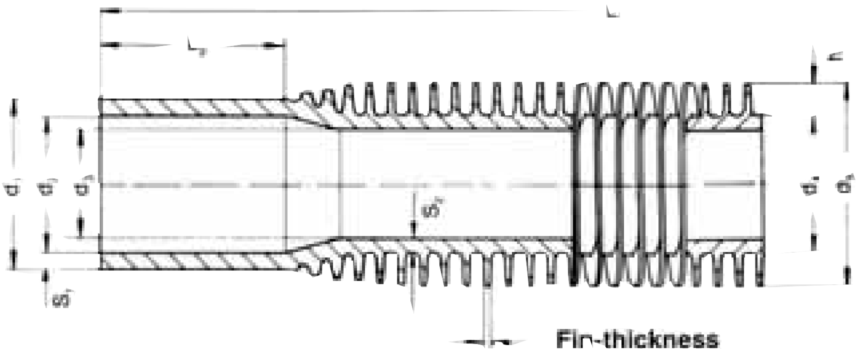
19 FINS/ INCH   FIN PITCH M = 1.33

Plain section					Finned section							
Code No. TECHNIFIN „N"	External Ø Inch	External Ø d1 mm	Int. d2 mm	Wall-thickn. S1 mm	Root dia. Ø Int. d3 mm	Root dia. Ø Ext. d4 mm	Ext. Ø d5 mm	Wall-thickn. BWG	Wall-thickn. S2 mm	Ext. surface Aa m²/m	Radio outs. to ins. Aa/Ai	Weight G Cu ca. kg/m
19.1/2.21	1/2"	12,70	10,30	1,20	7,90	9,50	12,50	21	0,80	0,1	4,0	0,32
19.1/2.20			10,10	1,30	7,70			20	0,90		4,1	0,34
19.1/2.19			9,90	1,40	7,50			19	1,00		4,2	0,38
19.1/2.18			9,50	1,60	7,00			18	1,25		4,5	0,42
19.5/8.21	5/8"	15,90	13,40	1,25	11,10	12,70	15,70	21	0,80	0,12	3,6	0,44
19.5/8.20			13,20	1,35	10,90			20	0,90		3,7	0,47
19.5/8.19			13,00	1,45	10,70			19	1,00		3,8	0,51
19.5/8.18			12,60	1,65	10,20			18	1,25		4,0	0,58
19.5/8.17			11,90	2,00	9,70			17	1,50		4,2	0,69
19.5/8.16			11,60	2,15	9,40			16	1,65		4,3	0,74
19.3/4.20	3/4"	19,00	16,30	1,35	14,00	15,80	18,80	20	0,90	0,15	3,5	0,61
19.3/4.19			16,10	1,45	13,80			19	1,00		3,6	0,63
19.3/4.18			15,70	1,65	13,30			18	1,25		3,7	0,72
19.3/4.17			15,00	2,00	12,80			17	1,50		3,8	0,83
19.3/4.16			14,80	2,10	12,50			16	1,65		3,9	0,88
19.3/4.14			14,10	2,45	11,60			14	2,10		4,2	1,03
19.7/8.19	7/8"	22,20	19,30	1,45	17,00	19,00	22,00	19	1,00	0,18	3,4	0,80
19.7/8.18			18,90	1,65	16,50			18	1,25		3,5	0,89
19.7/8.17			18,20	2,00	16,00			17	1,50		3,6	1,00
19.7/8.16			18,00	2,10	15,70			16	1,65		3,7	1,07
19.7/8.14			17,30	2,45	14,80			14	2,10		3,9	1,26
19.1.18	1"	25,40	22,10	1,65	19,70	22,20	25,20	18	1,25	0,21	3,4	1,05
19.1.17			21,40	2,00	19,20			17	1,50		3,5	1,19
19.1.16			21,10	2,15	18,90			16	1,65		3,6	1,27
19.1.14			20,50	2,45	18,00			14	2,10		3,7	1,50

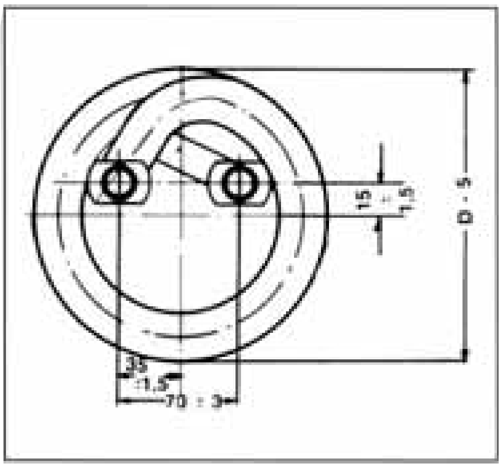
26 FINS/ INCH   FIN PITCH M = 0.97

Plain section					Finned section							
Code No. TECHNIFIN „N"	External Ø Inch	External Ø d1 mm	Int. d2 mm	Wall-thickn. S1 mm	Root dia. Ø Int. d3 mm	Root dia. Ø Ext. d4 mm	Ext. Ø d5 mm	Wall-thickn. BWG	Wall-thickn. S2 mm	Ext. surface Aa m²/m	Radio outs. to ins. Aa/Ai	Weight G Cu ca. kg/m
26.1/2.21	1/2"	12,70	10,30	1,20	7,90	9,50	12,50	21	0,80	0,12	5,0	0,34
26.1/2.19			9,90	1,40	7,50			19	1,00		5,3	0,40
26.1/2.18			9,50	1,60	7,00			18	1,25		5,8	0,45
26.5/8.21	5/8"	15,90	13,40	1,25	11,10	12,70	15,70	21	0,80	0,16	4,6	0,46
26.5/8.19			13,00	1,45	10,70			19	1,00		4,8	0,53
26.5/8.18			12,60	1,65	10,20			18	1,25		5,0	0,60
26.3/4.20	3/4"		16,30	1,35	14,00	15,80	18,80	20	0,90	0,20	4,5	0,63
26.3/4.19			16,10	1,45	13,80			19	1,00		4,6	0,67
26.3/4.18			15,70	1,65	13,30			18	1,25		4,8	0,77
26.7/8.19	7/8"	22,20	19,30	1,45	17,00	19,00	22,00	19	1,00	0,23	4,4	0,81
26.7/8.18			18,90	1,65	16,50			18	1,25		4,5	0,93
26.7/8.17			18,20	2,00	16,00			17	1,50		4,7	1,04
26.1.18	1"	25,40	22,10	1,65	19,70	22,20	25,20	18	1,25	0,27	4,4	1,09
26.1.17			21,40	2,00	19,20			17	1,50		4,5	1,23
26.1.16			21,10	2,15	18,90			16	1,65		4,6	1,31

Weights are based on SF-Cu Copper. For other materials please apply the following conversion factors: CuNi 70/30: 1.0, CuNi 90/10: 1.0, Aluminium Brass: 0.93, Admiralty Brass: 0.96, Aluminium: 0.31, Steel: 0.88



d_1	d_3	d_4 stripped	S_1	S_2	L_2	L_1
+0 -0,2	± 0,13	+0 -0,2	± 10%	± 10%	+5 -0	up to 2000 mm + 2 mm 2000 - 8000 mm + 1 ‰, max. 5 mm over 8000 mm + 0,7 ‰



Fields of application

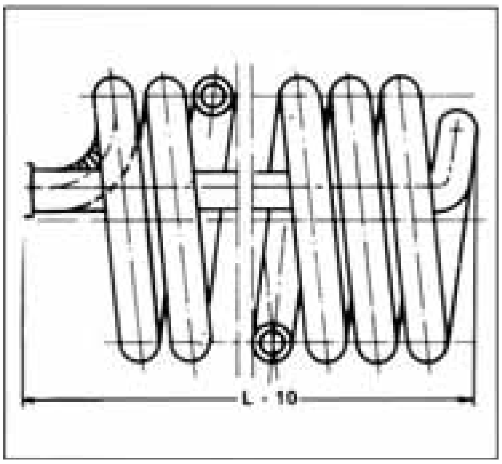
Water heating, solar technics, oil-cooling, heat-exchangers, condensers, evaporators.

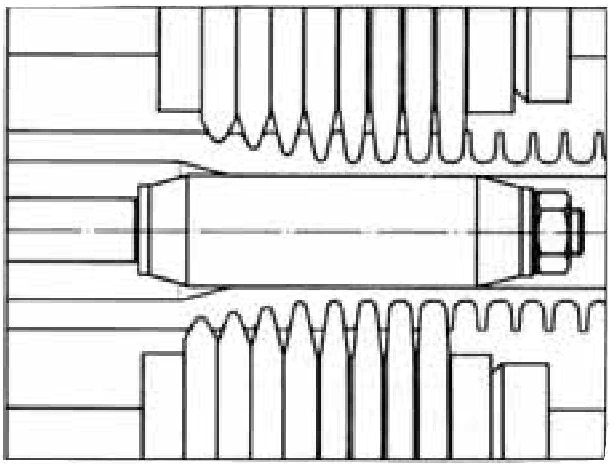
Manufacturing process

The fins are rolled out of the wall of the plain tube as type „N", but higher fins.

Advantages

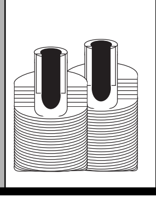
Economical solution of heat-exchange problems of media with different heat conduction abilities or different current conditions. High chemical-, thermal- and mechanical resistance, suitable for rough working conditions.





TECHNIFIN® Type "M"

Standard Size Range



Fins per inch : 11 Fin-height: h=3,5 mm ± 0,35 mm Fin thickness ~ 0,3 mm Length max. 12,0 m

External Ø	Int. Ø	Wall-thic-kn.	Root dia.		Ext.	Wall-thickn.		Ext. surface	Radio outs. to ins.	Weight
			Int. Ød3	Ext. Ød4						
d1	d2	S1			Ød5	BWG	S2	Aa	Aa/Ai	G Cu
mm	mm	mm	mm	mm	mm		mm	m²/m		ca. kg/m
13,00	9,40	1,80	7,90	9,50	16,50	21	0,80	0,16	6,5	0,50
13,00	9,00	2,00	7,50	9,50	16,50	19	1,00	0,16	6,7	0,53
16,00	12,40	1,80	10,90	12,50	19,50	21	0,80	0,19	5,6	0,61
16,00	12,00	2,00	10,50	12,50	19,50	19	1,00	0,19	5,8	0,67
18,00	14,00	2,00	12,50	14,50	21,50	19	1,00	0,21	5,4	0,77
18,00	13,50	2,25	12,00	14,50	21,50	18	1,25	0,21	5,6	0,85
22,00	18,00	2,00	16,50	18,50	25,50	19	1,00	0,27	5,2	0,96
22,00	17,50	2,25	16,00	18,50	25,50	18	1,25	0,27	5,4	1,06
28,00	23,50	2,25	22,00	24,50	31,50	18	1,25	0,34	4,9	1,45
28,00	23,00	2,50	21,50	24,50	31,50	17	1,50	0,34	5,1	1,60

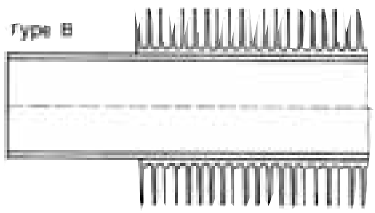
Alloys:	SF-Cu	CuAsP	CuNi10Fe	Al 99,5	AlMn	AlMg 3
Weight Conversion factor:	1,0	1,0	1,0	0,31	0,31	0,31

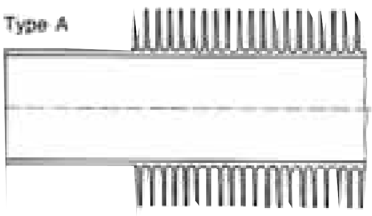
Alloy table for fin-tubes TECHNIFIN® Type "N" and "M"

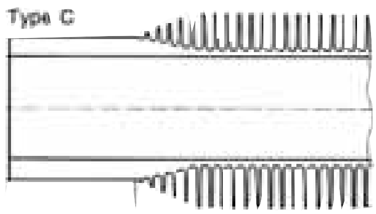
Alloys available				Properties of various alloys (Standard value)				
				Plain tube section			Finned section	
Alloy-No. DIN 17007	Designation	DIN*	Weight G/G Cu	Tensile strength Rm min. N/mm2	0,2 Yield str. RP 0,2 N/mm2	Elongation A 5 min. %	Tensile str. Rm N/mm2	State
2.0090	SF-Cu	1787	1,00	220	50-120	40	350	1,3
2.1491	CuAsP	17666	1,00	220	50-120	40	350	1,3
2.0470	CuZn28Sn	17660	0,96	320	100-170	55	340	2
2.0460	CuZn20Al	17660	0,93	340	120-180	55	340	2
2.0872	CuNi10Fe	17664	1,00	290	90-180	30	400	1,3
2.0882	CuNi30Fe	17664	1,00	370	120-220	35	500	1,3
3.0255	Al99,5	1712	0,30	100	70	6	130	1
3.3535	AlMg3	1725	0,30	180	80	12	230	1
3.0515	AlMn	1725	0,31	125	90	6	160	1
1.4301	5 CrNi 18 9	17440	0,88	500	185	25	700	1,3
1.4571	10 CrNiMoTi	17440	0,88	500	185	25	700	1,3
1.0308	St35	1629	0,88	350	240	25	500	1,2,3,
1.0305	St35.8	17175	0,88	360	235	25	500	1,2,3,

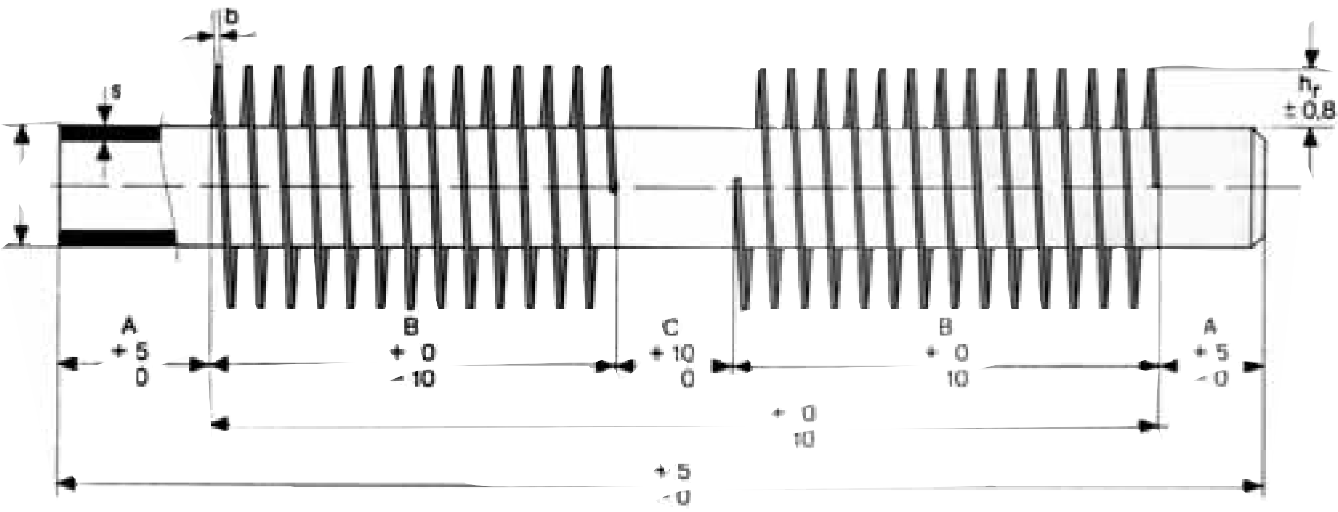
* or corresponding foreign standards 1. hard, as fined - 2. relieved, annealed - 3. Heat treatment acc. to your request











Fields of application

Fired Heaters, Heat Exchangers, Boilers, Pre-Heaters, Coolers, Heat Pipes, Dryers, Heaters

Manufacturing process

The fin strip is spirally wound onto the tube and welded continuously to the tube along the spiral foot.
Welding process: HF, SF, TIG, MIG
For type „WOS“ find are serrated.

Advantage

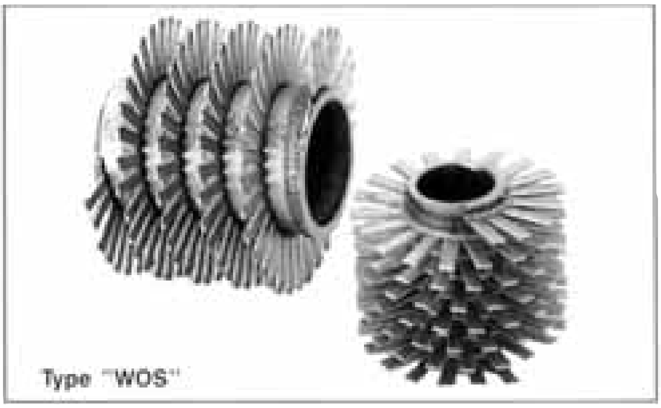
Type „WO“

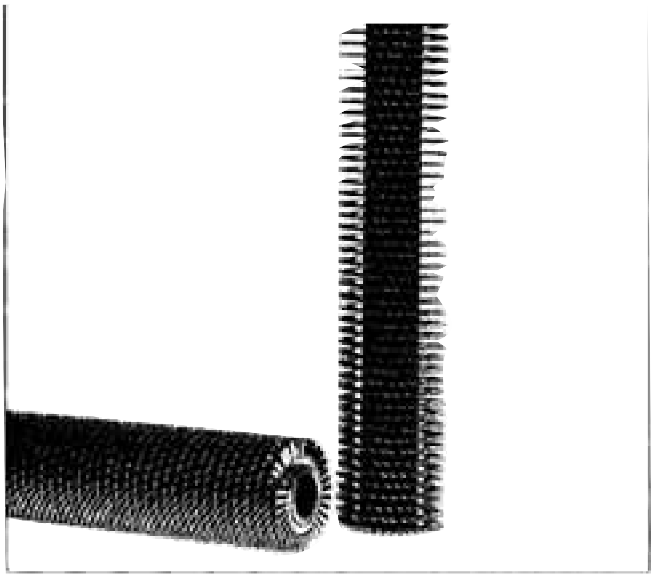
Strong connection between fin and base tube, prevents loosening of fin because of heat stress, oxydization, corrosion etc.
Use at very high temperatures possible.

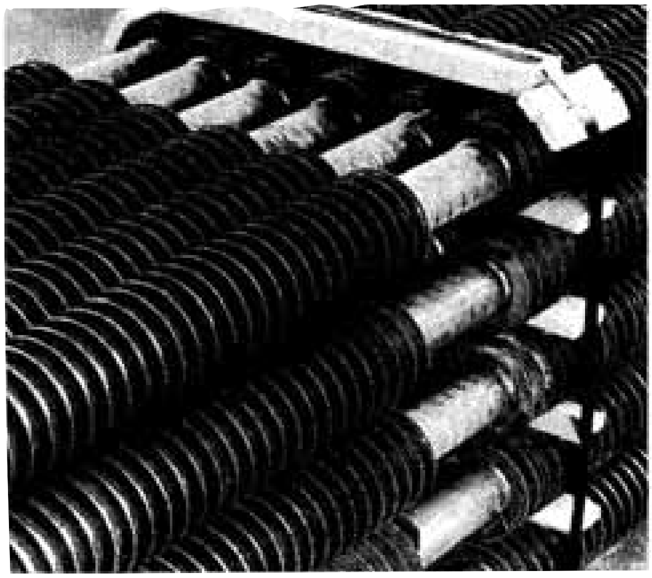
Type „WOS“

As per Type „WO“, but fins are serrated. Therefore higher heat transfer coefficient, for the same pressure drop compared with „WO“-fin.


Type "WO"


Type "WOS"





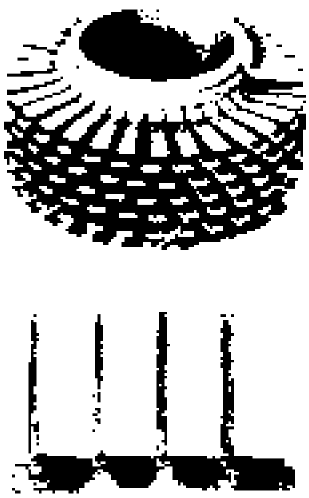
Materials

Base tube	**Fins**
Carbon Steel	Carbon Steel
Low Alloy Steel	Low Alloy Steel
Stainless Steel	Ferritic Stainless Steel
Nickel Alloys	Austenitic Stainless Steel
	Nickel Alloys

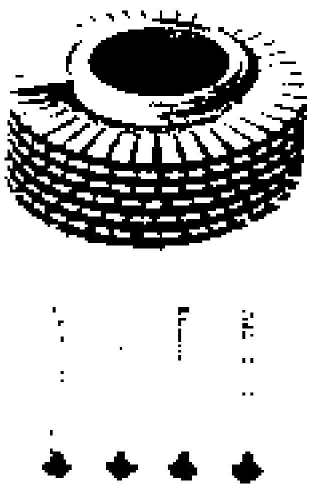
Heat transfer surface to be calculated al follows:

$$HTS = \frac{\pi}{106}\left[10^3 \cdot da + 2N \cdot HR\,(HR + da) - N \cdot da \cdot b\right]$$

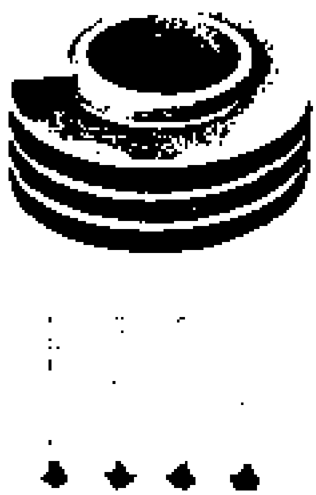
HTS	=	Heat Transfer Surface in m2/m
da	=	Outside Diameter of the Bare Tubes in mm
HR	=	Fin height in mm
b	=	Fin Thickness in mm
N	=	Number of Fins per mm



Type "WOS"



Type "WOS"



Type "WO"



Core Tubes O.D. d_a mm	Wall thickn s mm	Surface area F´k m2/m	Weight Gk kg/m	Number of fins N per m	per inch	10 x 1,3 m²/m	10 x 1,3 kg/m	13 x 1,3 m²/m	13 x 1,3 kg/m	15 x 1,3 m²/m	15 x 1,3 kg/m	19 x 1,5 m²/m	19 x 1,5 kg/m	25 x 1,5 m²/m	25 x 1,5 kg/m
				250	6,35	0,44	2,72								
				200	5	0,36	2,30								
16	1,8	0,05	0,63	150	3,8	0,29	1,88								
				118	3	0,24	1,64								
				100	2,5	0,21	1,47								
				250	6,35	0,54	3,46								
				200	5	0,44	2,96								
21,3	2	0,07	0,95	150	3,8	0,35	2,46								
				118	3	0,29	2,14								
				100	2,5	0,26	1,96								
				250	6,35	0,60	3,94	0,83	5,09						
				200	5	0,50	3,38	0,68	4,30						
25	2	0,08	1,13	150	3,8	0,39	2,82	0,53	3,51						
				118	3	0,33	2,46	0,43	3,01						
				100	2,5	0,29	2,26	0,38	2,72						
				200	5	0,60	4,55	0,81	5,61	0,96	6,37				
				150	3,8	0,48	3,88	0,63	4,67	0,74	5,25				
31,8	2,6	0,10	1,87	118	3	0,40	3,46	0,52	4,08	0,61	4,53				
				100	2,5	0,35	3,22	0,45	3,74	0,53	4,13				
				80	2	0,30	2,95	0,38	3,37	0,44	3,68				
				200	5	0,69	5,82	0,92	7,00	1,09	7,84	1,44	10,8		
				150	3,8	0,55	5,05	0,72	5,93	0,85	6,57	1,11	8,76		
38	3,2	0,12	2,75	118	3	0,46	4,56	0,59	5,26	0,69	5,76	0,90	7,48		
				100	2,5	0,41	4,29	0,52	4,87	0,60	5,30	0,78	6,76		
				80	2	0,35	3,98	0,44	4,45	0,51	4,79	0,65	5,96		
				200	5	0,85	7,30	1,11	8,67	1,31	9,64	1,71	13,0		
				150	3,8	0,67	6,36	0,87	7,39	1,02	8,12	1,32	10,7		
48,3	3,2	0,15	3,56	118	3	0,56	5,76	0,72	6,57	0,83	7,15	1,07	9,14		
				100	2,5	0,50	5,43	0,63	6,11	0,73	6,60	0,93	8,29		
				80	2	0,43	5,06	0,54	5,61	0,61	6,00	0,78	7,35		
				200	5	0,89	7,68	1,16	9,10	1,36	10,1	1,78	13,6	2,50	17,8
				150	3,8	0,70	6,70	0,91	7,77	1,06	8,53	1,38	11,2	1,92	14,3
51	3,2	0,16	3,77	118	3	0,59	6,08	0,75	6,92	0,87	7,52	1,12	9,58	1,54	12,1
				100	2,5	0,52	5,73	0,66	6,44	0,76	6,95	0,97	8,69	1,33	10,8
				80	2	0,45	5,34	0,56	5,91	0,64	6,31	0,81	7,71	1,10	9,4
				200	5	0,97	8,54	1,28	10,1	1,49	11,2	1,94	14,9	2,70	19,4
				150	3,8	0,78	7,47	1,00	8,62	1,16	9,44	1,50	12,3	2,07	15,6
57	3,2	0,18	4,24	118	3	0,65	6,78	0,83	7,69	0,95	8,33	1,22	10,6	1,67	13,2
				100	2,5	0,58	6,39	0,73	7,16	0,84	7,71	1,06	9,59	1,44	11,8
				80	2	0,50	5,96	0,62	6,58	0,70	7,02	0,88	8,52	1,19	10,3
				200	5	1,02	9,01	1,34	10,6	1,56	11,7	2,03	15,7	2,81	20,3
				150	3,8	0,82	7,88	1,05	9,09	1,22	9,94	1,57	12,9	2,16	16,3
60,3	3,2	0,19	4,5	118	3	0,68	7,16	0,87	8,11	1,00	8,78	1,27	11,1	1,74	13,8
				100	2,5	0,61	6,76	0,76	7,56	0,88	8,13	1,11	10,1	1,50	12,4
				80	2	0,52	6,31	0,65	6,95	0,74	7,40	0,93	8,97	1,24	10,8

Fin height x fin thickness (HR x b): Fin tube surface area / fin tube weight

Formula for Calculation of Fin Tube Weight: - Carbon Steel -

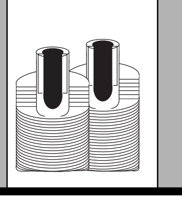
$$kg/m = \frac{7{,}85 \cdot \pi}{10^6} \left[1000 \cdot s\,(da - s) + b \cdot N \cdot HR\,(HR + da) \right]$$

da = bare pipe O.D. (mm)
s = bare pipe wallthickness (mm)
b = fin thickness (mm)
N = fins per meter
HR = fin height (mm)

This is a simplified formula and should be used as estimation only, since manufacturing tolerances are not considered

Factor other than Carbon Steel:

Type 304/310/316/321	: 1.024	Techalloy 200	: 1.133
Techalloy 600/625	: 1.073	Techalloy 825	: 1.038



Core Tubes O.D. d_a mm	Wall thickness s mm	Surface area F'k m2/m	Weight Gk kg/m	Number of fins N per m	per inch	Fin height x fin thickness (HR x b) Fin tube surface area / fin tube weight 10 x 1, m²/m	kg/m	13 x 1, m²/m	kg/m	15 x 1,3 m²/m	kg/m	19 x 1,5 m²/m	kg/m	25 x 1,5 m²/m	kg/m
				200	5	1,26	11,3	1,63	13,2	1,89	14,5	2,44	19,1	3,34	24,4
				150	3,8	1,00	9,89	1,28	11,3	1,48	12,3	1,89	15,8	2,57	19,8
76,1	3,2	0,24	5,75	118	3	0,84	9,01	1,06	10,1	1,22	10,9	1,54	13,6	2,07	16,8
				100	2,5	0,75	8,51	0,94	9,46	1,07	10,1	1,34	12,4	1,79	15,1
				80	2	0,65	7,96	0,80	8,72	0,90	9,26	1,12	11,1	1,48	13,2
				200	5	1,45	13,1	1,87	15,3	2,16	16,8	2,77	21,9	3,77	27,8
				150	3,8	1,16	11,5	1,47	13,1	1,69	14,3	2,15	18,1	2,90	22,6
88,9	3,2	0,28	6,76	118	3	0,97	10,5	1,22	11,8	1,39	12,7	1,75	15,7	2,34	19,2
				100	2,5	0,86	9,93	1,08	11,0	1,22	11,8	1,53	14,3	2,03	17,3
				80	2	0,75	9,30	0,92	10,2	1,03	10,8	1,28	12,8	1,68	15,2
				200	5	1,64	15,9	2,11	18,3	2,43	19,9	3,10	25,6	4,20	32,1
				150	3,8	1,31	14,1	1,66	15,9	1,91	17,1	2,41	21,4	3,23	26,3
101,6	3,6	0,32	8,70	118	3	1,10	12,9	1,37	14,3	1,57	15,3	1,96	18,7	2,61	22,5
				100	2,5	0,98	12,3	1,21	13,5	1,38	14,3	1,71	17,2	2,26	20,4
				80	2	0,85	11,6	1,04	12,5	1,17	13,2	1,43	15,5	1,87	18,1
				200	5			2,34	20,4	2,70	22,3	3,43	28,6	4,63	35,6
				150	3,8			1,85	17,8	2,12	19,2	2,66	23,9	3,56	29,1
114,3	3,6	0,36	9,82	118	3			1,53	16,1	1,74	17,2	2,17	20,9	2,88	25,0
				100	2,5			1,35	15,1	1,53	16,0	1,90	19,2	2,49	22,7
				80	2			1,15	14,1	1,30	14,8	1,59	17,3	2,07	20,1
				200	5			2,85	26,4	3,27	28,6	4,14	36,1	5,53	44,3
				150	3,8			2,25	23,2	2,57	24,8	3,21	30,4	4,26	36,6
141,3	4,0	0,44	13,5	118	3			1,86	21,1	2,11	22,4	2,62	26,8	3,45	31,7
				100	2,5			1,65	19,0	1,86	21,1	2,29	24,8	2,99	28,9
				80	2			1,41	18,7	1,58	19,6	1,92	22,6	2,48	25,8
				200	5			3,18	31,5	3,65	33,9	4,60	42,2	6,13	51,2
				150	3,8			2,51	27,9	2,86	29,7	3,57	35,9	4,72	42,7
159	4,5	0,50	17,14	118	3			2,08	25,6	2,36	27,0	2,92	31,9	3,82	37,2
				100	2,5			1,84	24,3	2,07	25,5	2,55	29,6	3,31	34,2
				80	2			1,57	22,9	1,76	23,8	2,14	27,1	2,75	30,8
				200	5			3,35	33,3	3,85	35,8	4,84	44,5	6,44	53,9
				150	3,8			2,65	29,5	3,02	31,4	3,76	37,9	4,96	45,0
168,3	4,5	0,53	18,17	118	3			2,19	27,1	2,49	28,6	3,07	33,7	4,02	39,3
				100	2,5			1,94	25,7	2,19	27,0	2,68	31,3	3,48	36,0
				80	2			1,66	24,2	1,86	25,2	2,25	28,7	2,89	32,5
				200	5			3,83	42,3	4,38	45,1	5,50	55,0	7,29	65,5
				150	3,8			3,02	38,0	3,44	40,1	4,28	47,5	5,62	55,4
193,7	5,4	0,61	25,06	118	3			2,51	35,2	2,84	36,9	3,50	42,7	4,55	48,9
				100	2,5			2,22	33,7	2,50	35,1	3,06	40,0	3,95	45,3
				80	2			1,90	32,0	2,12	33,1	2,57	37,0	3,28	41,2
				200	5			4,30	50,3	4,92	53,2	6,16	64,5	8,15	76,1
				150	3,8			3,40	45,5	3,86	47,9	4,80	56,1	6,28	64,9
219,1	5,9	0,69	31,01	118	3			2,82	42,4	3,19	44,3	3,92	50,7	5,09	57,6
				100	2,5			2,49	40,7	2,80	42,3	3,43	47,7	4,42	53,6
				80	2			2,13	38,7	2,38	40,0	2,88	44,4	3,67	49,1



Many other sizes upon request - ask TPS!

Dimensions

Core tubes: to DIN 2448,2458 or ANSI B 36.10 from 16 to 219.1 mm O.D. (other dimensions upon enquiry)

Fins: 50 to 250 fins per meter finned tube
Height: up to 50 mm
Thickness: 0.9 to 6.0 mm
Number of fins and dimensions depend upon core tube diameter. For dimensions not listed in the above table, please gibe your detailed enquiry.

Lengths: Limited only by transportation facilities or availability of core tube

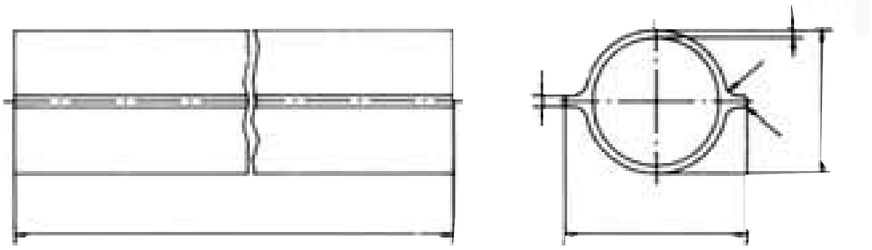
Dimensional tolerances:
Core tube:to respective core tube specification
Fin height: ± 0.8 mm
Number of fins:+ 2%/m
Free ends: + 5mm
Free sections: + 10 mm

Fin design
free ends

free sections on the core tube

End shapes
plain
calibrated

bevelled for welding on one side to DIN 2559
bevelled for welding on both sides or ANSI B 16.25



Standard Size Range

Inside diameter: 29 - 110 mm
Wall thickness: 3.2 - 20 mm
W.T. ratio: approx 10% O.D.
Lenght: max. 11 - 12 meter
Fin dia: max. 200 mm

Eccentricity: max. 10%

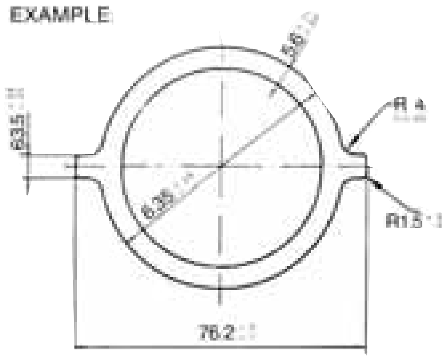
Max. torsion up to 6 mtr-L = 1,5 mm
6 - 8 mm-L = 2.25 mm
8 mtr and longer-L = 3.0 mm
Straightness: max. 0,2%
on total length

Field of application

Boiler water wall constructions
Water power plants
Atomic power stations
Steam generators
Gas recuperators
Flue tube boilers
Fuel element coils

Advantage

The fin tube is seamless and manufactured out of equal raw material.
No welding seams.

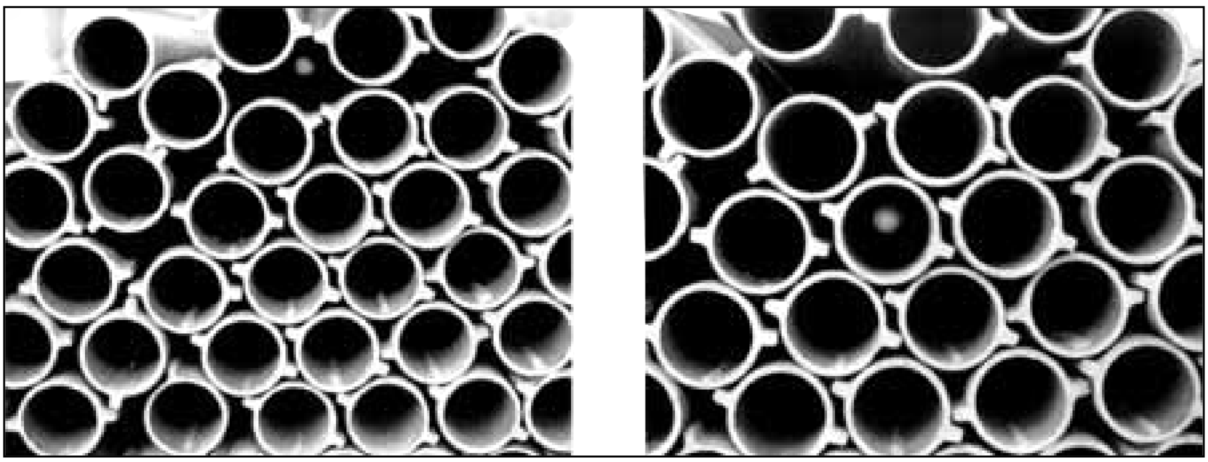


Materials

Mainly Carbon Steels, Ferritic Alloy and Austenitic Stainless Steel, Nickel Alloy

Manufacturing Process

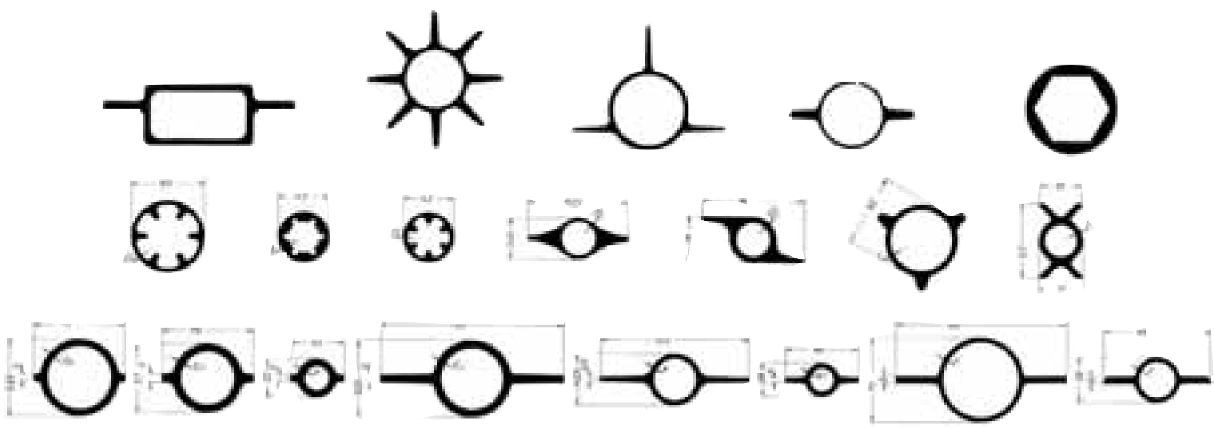
Hot-extrusion process
Cold drawn process

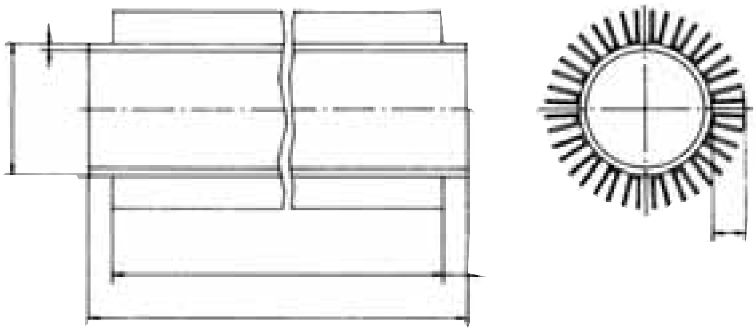


Standard Size Range

Tube d	Width of profile e	Typical wall thicknesses 3,2	3,6	4,0	4,5	5,0	5,6	6,2	Fin thickness b1	b2	r
		Weight kg/m									
25,0	36,0	2,15	2,33	2,50	2,71	2,90			4,5	5,5	5
26,9	37,5	2,39	2,59	2,78	2,98	3,20	3,44	3,71	5,0	6,0	5
30,0	42,5	2,72	2,95	3,17	3,41	3,66	3,95	4,28	5,0	6,0	5
	45,0	2,83	3,06	3,28	3,52	3,77	4,06	4,39			
	47,5	2,94	3,17	3,39	3,63	3,88	4,17	4,50			
31,8	45,0	2,90	3,16	3,39	3,65	3,93	4,23	4,60	5,0	6,5	5
	47,5	3,02	3,27	3,51	3,77	4,05	4,35	4,72			
	50,0	3,13	3,38	3,62	3,88	4,16	4,46	4,83			
33,7	45,0	2,88	3,15	3,41	3,69	4,00	4,33	4,73	5,5	7,0	5
	47,5	3,14	3,41	3,67	3,95	4,26	4,59	4,99			
	50,0	3,26	3,53	3,79	4,07	4,38	4,71	5,11			
38,0	50,0	3,55	3,86	4,16	4,49	4,85	5,25	5,37	6,0	8,0	6
	52,5	3,69	4,00	4,30	4,63	4,99	5,39	5,51			
	57,5	3,97	4,28	4,58	4,91	5,27	5,67	5,79			
42,4	52,5		4,15	4,49	4,87	5,29	5,75	6,30	6,0	8,0	6
	57,5		4,42	4,76	5,14	5,56	6,02	6,57			
	60,0		4,56	4,90	5,28	5,70	6,16	6,81			
44,5	60,0		4,69	5,06	5,46	5,91	6,39	6,99	6,5	8,5	6
	65,0		4,98	5,35	5,75	6,20	6,68	7,28			
48,3	65,0		5,11	5,52	5,96	6,45	7,00	7,66	6,5	8,5	6
	70,0		5,40	5,81	6,25	6,74	7,39	7,95			
51,0	65,0		5,23	5,66	6,13	6,67	7,24	7,95	7,0	9,0	6
	70,0		5,55	5,98	6,45	6,98	7,56	8,27			
57,0	70,0			6,21	6,75	7,35	8,02	8,85	7,0	9,0	6
	75,0			6,52	7,06	7,66	8,33	9,16			
60,3	75,0			6,64	7,22	7,87	8,68	9,47	7,0	9,0	6
	80,0			6,95	7,53	8,18	8,89	9,78			
63,5	80,0			7,07	7,68	8,37	9,13	10,07	7,0	9,0	6
	85,0			7,38	7,99	8,68	9,44	10,38			
70,0	85,0			7,73	8,42	9,19	10,03	11,10	7,5	9,5	7
	90,0			8,07	8,76	9,53	10,37	11,44			
76,1	90,0			8,28	9,03	9,88	10,82	12,01	7,5	9,5	7
	95,0			8,61	9,36	10,21	11,15	12,34			

In addition to longitudinal fin tubes, sections of many shapes can be produced by hot extrusion with two or more internal and/or external fins in the size range mentioned on the left page.

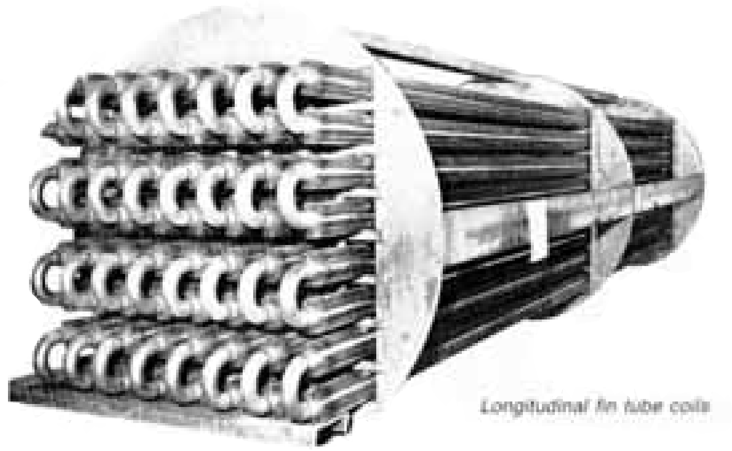




Size Range
As per opposite page

Fields of application
Chemical-, Petrochemical-, Oil-,
Power Industry
Heat-Exchangers
Fired Heaters
Gas Coolers and Heaters
Tank Heaters

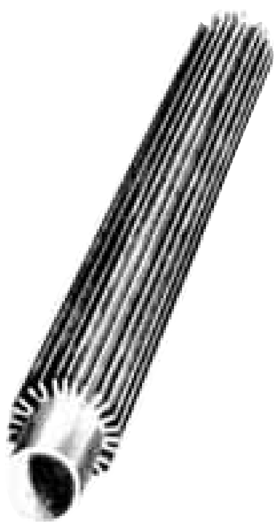
Manufacturing process
The longitudinal I/L or U fins are welded onto the base tubed by resistance welding or welding with filler metal.



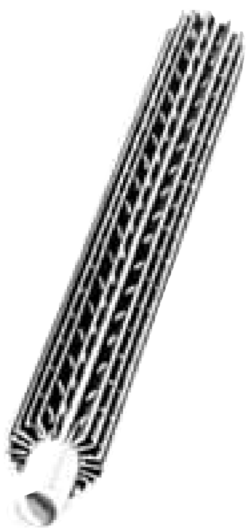
Longitudinal fin tube coils

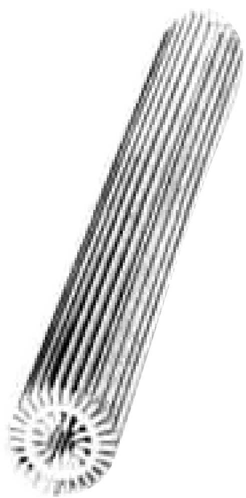
Advantage
Increase of heat transfer rates for viscous liquids. Perforated fin type used whenever drainage of liquid from fin channels become a problem. Widely used in horizontal heat-ex hangers.

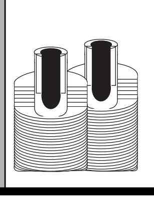
Material
Carbon Steel
Alloy Steel
Stainless Steel
Nickel Alloy
Other Alloys









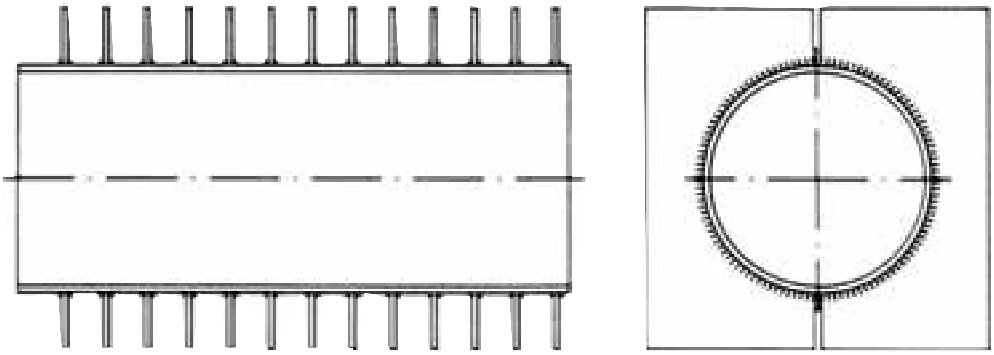


FINNED TUBE AND PIPE SURFACES square feet per foot of finned length						FINNED TUBE AND PIPE SURFACES m²/meter of finned length				
O.D. or Nominal Pipe Size	Fin Height				No. of Fins	Fin Height - mm				O.D. or Nominal Pipe Size
	1/4"	1/2"	3/4"	1"		6.35	12.7	19.05	25.4	
3/4" O.D.	0.863	1.529	2.196	2.863	16	0.2627	0.4654	0.6685	0.8715	19.05 mm
7/8" O.D.	0.895	1.562	2.229	2.896	16	0.2724	0.4755	0.6785	0.8816	22.22 mm
	1.062	1.895	2.729	3.562	20	0.3233	0.5768	0.8307	1.0843	
1" O.D.	0.928	1.595	2.262	2.928	16	0.2825	0.4855	0.6886	0.8913	25.4 mm
	1.095	1.928	2.762	3.595	20	0.3333	0.5869	0.8408	1.0944	
	1.262	2.262	3.262	4.262	24	0.3842	0.6886	0.9930	1.2974	
3/4" I.P.S. 1.05" O.D.	0.941	1.608	2.275	2.942	16	0.2865	0.4895	0.6925	0.8956	3/4" I.P.S. 26.67 mm
	1.108	1.941	2.775	3.608	20	0.3373	0.5909	0.8447	1.0983	
	1.275	2.275	3.275	4.275	24	0.3881	0.6925	0.9970	1.3014	
1 1/2" I.P.S. 1.9" O.D.	1.497	2.497	3.497	4.497	24	0.4557	0.7601	1.0645	1.3689	1 1/2" I.P.S. 48.26 mm
	1.830	3.163	4.497	5.830	32	0.5571	0.9629	1.3689	1.7747	
	2.163	3.830	5.497	7.163	40	0.6584	1.1659	1.6734	2.1805	
2" I.P.S. 2.375" O.D.	1.955	3.288	4.622	5.956	32	0.5951	1.0009	1.4070	1.8131	2" I.P.S. 60.32 mm
	2.288	3.955	5.622	7.288	40	0.6965	1.2040	1.7114	2.2186	

OBSTRUCTION - square inches						OBSTRUCTION - mm²				
O.D. or Nominal Pipe Size	Fin Height				No. of Fins	Fin Height - mm				O.D. or Nominal Pipe Size
	1/4"	1/2"	3/4"	1"		6.35	12.7	19.05	25.4	
3/4" O.D.	0.6215	0.7791	0.9367	1.0943	16	400.97	502.64	604.32	706.00	19.05 mm
7/8" O.D.	0.7810	0.9386	1.0962	1.2538	16	503.87	605.55	707.22	808.90	22.22 mm
	0.8259	1.0229	1.2199	1.4169	20	532.84	659.93	787.03	914.13	
1" O.D.	0.9651	1.1227	1.2803	1.4379	16	622.64	724.32	826.00	927.68	25.4 mm
	1.0100	1.2070	1.4040	1.6010	20	651.61	778.71	905.80	1032.90	
	1.0549	1.2913	1.5277	1.7641	24	680.58	833.10	985.61	1138.13	
3/4" I.P.S. 1.05" O.D.	1.0456	1.2032	1.3608	1.5184	16	674.58	776.26	877.93	979.61	3/4" I.P.S. 26.67 mm
	1.0905	1.2875	1.4845	1.6815	20	703.55	830.64	957.74	1084.84	
	1.1354	1.3718	1.6082	1.8446	24	732.51	885.03	1037.55	1190.06	
1 1/2" I.P.S. 1.9" O.D.	3.1048	3.3412	3.5776	3.8140	24	2003.09	2155.61	2308.12	2460.64	1 1/2" I.P.S. 48.26 mm
	3.1946	3.5098	3.8250	4.1402	32	2061.03	2264.38	2467.74	2671.09	
	3.2845	3.6785	4.0725	4.4665	40	2119.03	2373.22	2627.41	2882.61	
2" I.P.S. 2.375" O.D.	4.7894	5.1046	5.4198	5.7350	32	3089.93	3293.28	3496.64	3699.99	2" I.P.S. 60.32 mm
	4.8793	5.2733	5.6673	6.0613	40	3147.93	3402.12	3656.31	3910.51	

KEY TO TABLES:

- A tube of 1" O.D. with 24 fins 1/2" high has a total surface area of 0.079 + 0.610 = 0.689 m²/m
- A tube of 3/4" I.P.S. with 24 fins 1" high has a total surface area of 0.083 + 1.218 = 1.301 m²/m
- A tube of 2" I.P.S. with 40 fins 1/2" high has a total surface area of 0.189 + 1.016 = 1.205 m²/m



TechniFin Typ „S"

Standard Size Range Type „S"

Base Tube O.D.:	31.8 - 57 mm
Fin Size:	60 - 145 mm
Fin Pitch:	12.5 - 50 mm
Tube Length:	1 - 10 mm
Fin Thickness:	2 - 3 mm

Field of application:

Economisers, Biolers, Heat Exchangers.

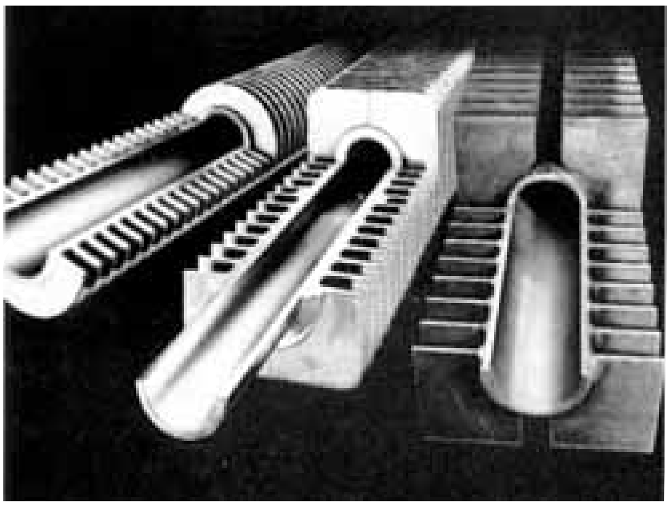
Often used in non-corrosive gas streams, minimal resistance to gas flow and the straight gas paths inhibit fouling and ease cleaning.

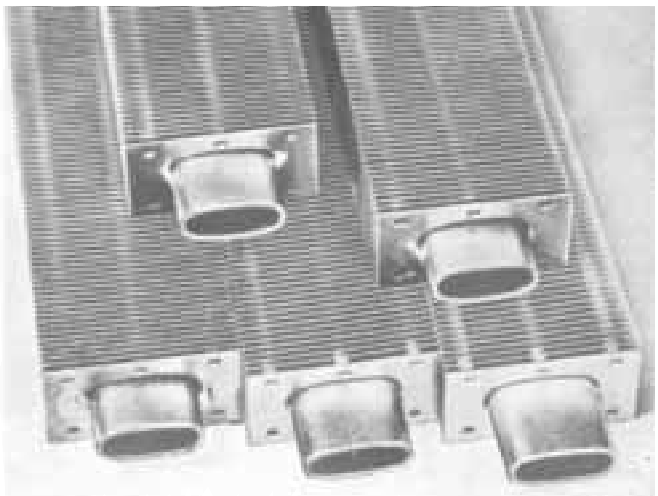
Manufacturing Process:

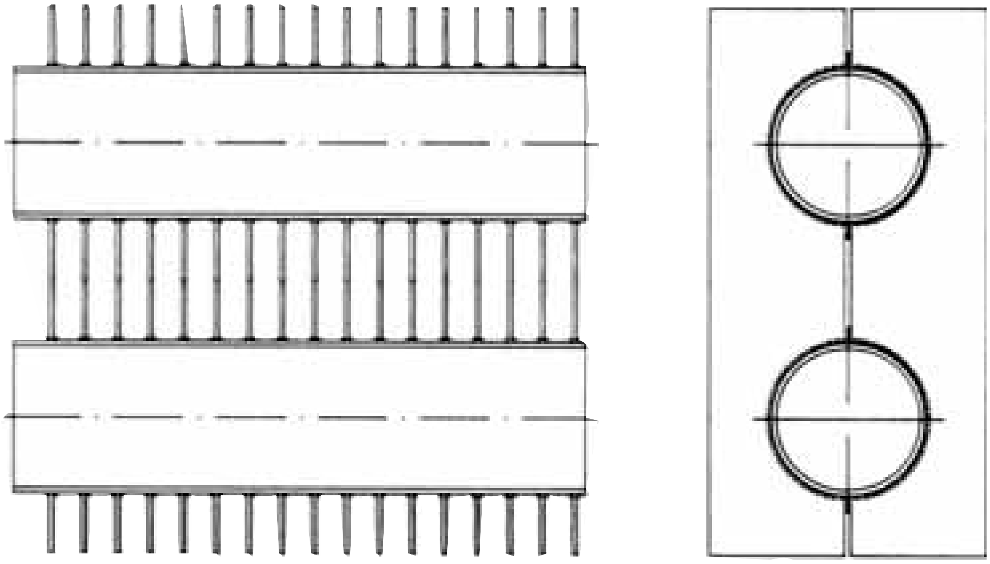
Square or rectangular fins are welded on a steel base tube.

Advantages:

High efficiency / Minimum power loss / easy cleaning







TechniFin Typ „DOUBLE S“

Standard Size Range Type „S“

Base Tube O.D.: 31.8 - 57 mm
Fin Size: 60 - 175 mm
Fin Pitch: 10 - 30 mm
Tube Length: 1 - 10 mm
Fin Thickness: 2 - 3 mm

Field of application:

Economisers, Biolers, Heat Exchangers.

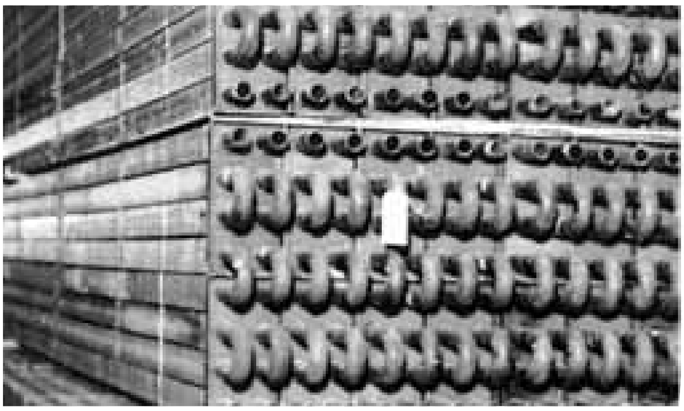
Often used in non-corrosive gas streams, minimal resistance to gas flow and the straight gas paths inhibit fouling and ease cleaning.

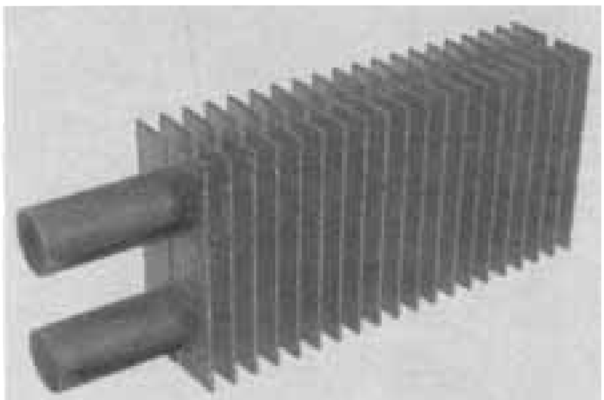
Manufacturing Process:

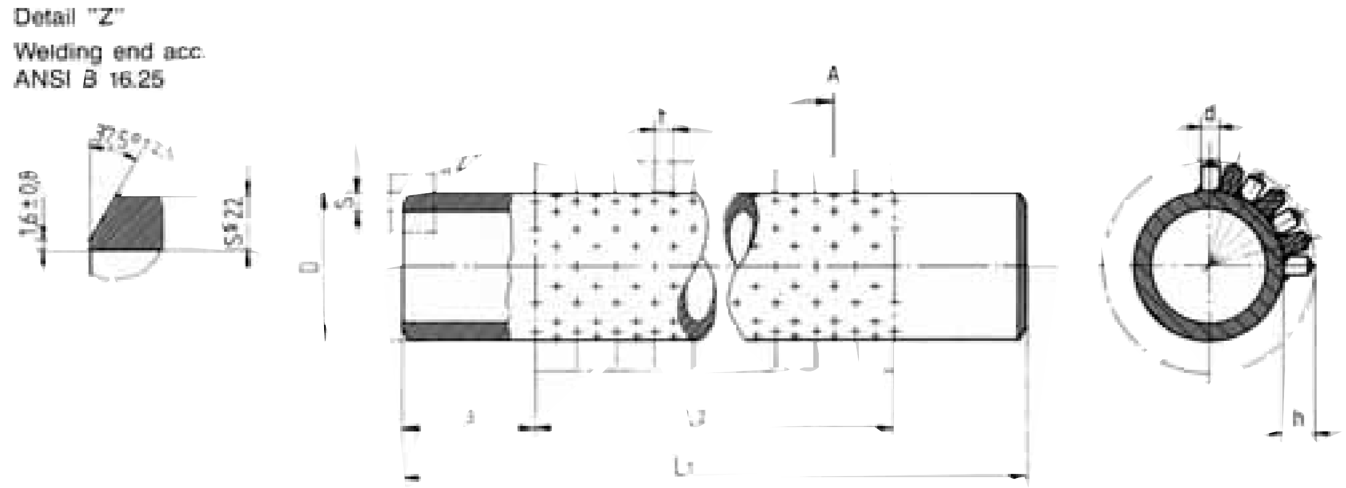
Square or rectangular fins are welded on two steel base tubes.

Advantages:

High efficiency / Minimum power loss / easy cleaning







L_1	max. 24 000 mm
L_2	max. (L_1 - 2 L_3 min.)
L_3	min. 20 mm
h	12.7 - 63.5 mm
d	8 - 12.7 mm
Std	15,87 mm ≙ 63 Rows / Meter

Fa	Studded Outer Tube Surface Area
Fi	Interior Tube Area
Da	Outside Diameter of Tube

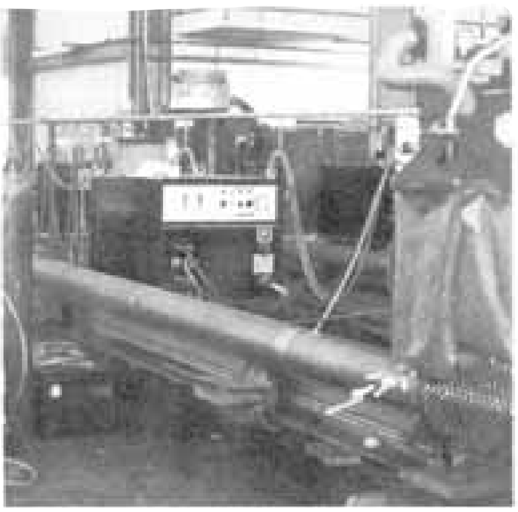
Di	Inside Diameter of Tube
NB	No. of Studs per Row
NRm	No. of Stud Rows per Meter

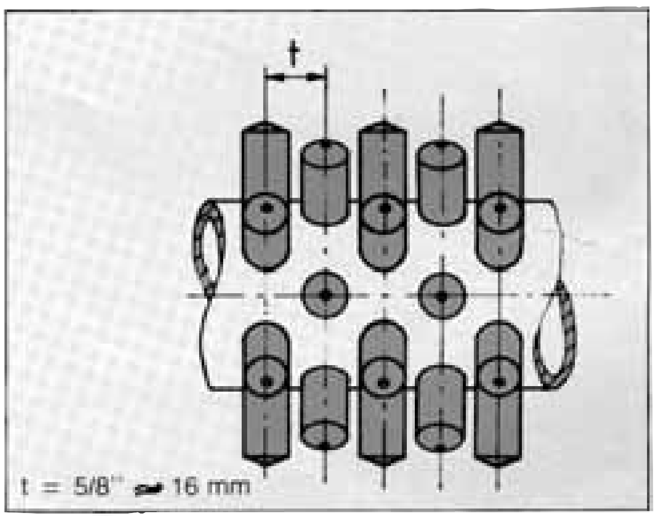
Standard Size Range:
See opposite page

Fields of Application:
Furnaces-, Chemical-, Petrochemical-Industry, Power stations etc. where liquid media under high pressure are to be heated or cooled.

Advantages
Due to their high rigidity, studded tubes can be used even under extreme temperature and pressure conditions.

Manufacturing Process:
Studs are fully automatically welded onto the tube by resistance welding.





Standard Tube Dimensions*							
Outside Diameter		Wallthickness		Max. Number of Studs per Row		Fi	Aspect Ratio** at: NB (max.), T = Stand. d (max.), h (max.)
mm	in.	mm	in.	d = 8 mm	d = 12,7 mm	m2/m	Fi
60,3	2.375	3,9	0.154	9	7	0,165	7,92
73,0	2.875	5,2	0.203	10	8	0,197	7,66
88,9	3.500	5,5	0.216	13	10	0,245	7,66
101,6	4.000	5,7	0.226	15	12	0,283	7,88
114,3	4.500	6,0	0.237	17	13	0,321	7,57
127,0	5.000	4,0	0.156	18	15	0,374	7,47
141,3	5.563	6,6	0.258	21	17	0,402	7,84
152,4	6.000	4,5	0.179	22	18	0,451	7,44
159,0	6.260	4,5	0.179	23	19	0,471	7,49
168,3	6.625	7,1	0.281	25	20	0,484	7,68
219,1	8.625	8,2	0.322	32	26	0,637	7,60

* The Standard Tube Dimensions given in the above table are taken from typical orders. Of course, we produce studded tubes also with other base tube dimensions in the range 60,3 up to 219,1 mm Outside Diameter.

** Calculation of Aspect Ratio: $Fi = \frac{d \times h \times NB \times NRm + Da}{Di}$

Materials:

Base Tube & Studs

Carbon Steel
Low Alloy Steel
Stainless Steel

Length:

Up to 24 meters. If necessary with circumferential weld, 100% x-rayed. If required pressure tested.

Studs:

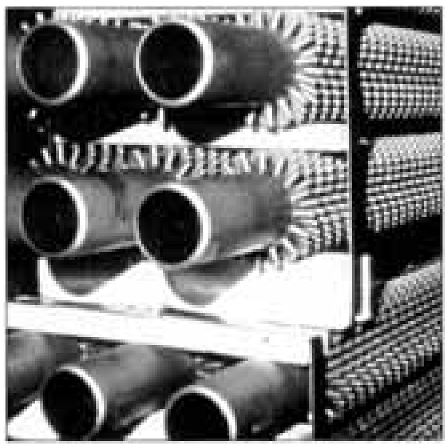
General Stud spacing 1/8" (16mm) = 63 Stud rows per meter

Type of Studs:

Cylindrical , elliptical or lens type







according to ANSI-B 36.10 supplemented with all new dimensions of API Stds. 5 L, 5 LS and 5 LX

Size	Outside Diameter		Wall Thickness		Weight		Identification		
in.	in.	mm	in.	mm	In/ft	kg/m	API	STD XS; XXS	Schedule No
1/8	0,405	10,30	0,068	1,7	0,24	0,357	5L	STD	40
			0,095	2,4	0,31	0,461	5L	XS	80
1/4	0,540	13,70	0,088	2,2	0,42	0,625	5L	STD	40
			0,119	3,0	0,54	0,804	5L	XS	80
3/8	0,675	17,10	0,091	2,3	0,57	0,848	5L	STD	40
			0,126	3,2	0,74	1,10	5L	XS	80
1/2	0,840	21,30	0,109	2,8	0,85	1,26	5L	STD	40
			0,147	3,7	1,09	1,62	5L	XS	80
			0,188	4,8	1,31	1,95	5L		160
			0,294	7,5	1,71	2,54	5L	XXS	
3/4	1,050	26,70	0,113	2,9	1,13	1,68	5L	STD	40
			0,154	3,9	1,47	2,19	5L	XS	80
			0,219	5,6	1,94	2,88	5L		160
			0,308	7,8	2,44	3,63	5L	XXS	
1	1,315	33,40	0,133	3,4	1,68	2,50	5L	STD	40
			0,179	4,5	2,17	3,23	5L	XS	80
			0,250	6,4	2,84	4,23	5L		160
			0,358	9,1	3,66	5,45	5L	XXS	
1 1/4	1,660	42,20	0,140	3,6	2,27	3,38	5L	STD	40
			0,191	4,9	3,00	4,46	5L	XS	80
			0,250	6,4	3,76	5,60	5L		160
			0,382	9,7	5,21	7,75	5L	XXS	
1 1/2	1,900	48,30	0,145	3,7	2,72	4,05	5L	STD	40
			0,200	5,1	3,63	5,40	5L	XS	80
			0,281	7,1	4,86	7,23	5L		160
			0,400	10,2	6,41	9,54	5L	XXS	
2	2,375	60,30	0,083	2,1	2,03	3,02	5L, 5LX		
			0,109	2,8	2,64	3,93	5L, 5LX		
			0,126	3,2	3,00	4,47	5L, 5LX		
			0,141	3,6	3,36	5,00	5L, 5LX		
			0,154	3,9	3,65	5,44	5L, 5LX	STD	40
			0,172	4,4	4,05	6,03	5L, 5LX		
			0,188	4,8	4,39	6,54	5L, 5LX		
			0,218	5,5	5,02	7,48	5L, 5LX	XS	80
			0,250	6,4	5,67	8,45	5L, 5LX		
			0,281	7,1	6,28	9,35	5L, 5LX		
			0,344	8,7	7,46	11,10			160
			0,436	11,1	9,03	13,40	5L, 5LX	XXS	

Size	Outside Diameter		Wall Thickness		Weight		Identification		
in.	in.	mm	in.	mm	ln/ft	kg/m	API	STD XS; XXS	Schedule No
2 1/2	2,875	73,00	0,083	2,1	2,47	3,68	5L, 5LX		
			0,109	2,8	3,22	4,80	5L, 5LX		
			0,125	3,2	3,67	5,46	5L, 5LX		
			0,141	3,6	4,12	6,12	5L, 5LX		
			0,156	4,0	4,53	6,75	5L, 5LX		
			0,172	4,4	4,97	7,40	5L, 5LX		
			0,188	4,8	5,40	8,04	5L, 5LX		
			0,203	5,2	5,79	8,62	5L, 5LX	STD	
			0,216	5,5	6,13	9,13	5L, 5LX		
			0,250	6,4	7,01	10,40	5L, 5LX		
			0,276	7,0	7,66	11,40	5L, 5LX	XS	80
			0,375	9,5	10,00	14,90			160
			0,552	14,0	13,70	20,40	5L, 5LX	XXS	
3	3,500	88,90	0,083	2,1	3,03	4,51	5L, 5LX		
			0,109	2,8	3,95	5,88	5L, 5LX		
			0,125	3,2	4,57	6,72	5L, 5LX		
			0,141	3,6	5,06	7,54	5L, 5LX		
			0,156	4,0	5,57	8,30	5L, 5LX		
			0,172	4,4	6,11	9,10	5L, 5LX		
			0,188	4,8	6,65	9,91	5L, 5LX		
			0,216	5,5	7,58	11,3	5L, 5LX	STD	40
			0,250	6,4	8,68	12,9	5L, 5LX		
			0,281	7,1	9,66	14,4	5L, 5LX		
			0,300	7,6	10,30	15,3	5L, 5LX	XS	80
			0,438	11,1	14,30	21,3			160
			0,600	15,2	18,60	27,7	5L, 5LX	XXS	
3 1/2	4	101,60	0,083	2,1	3,47	5,17	5L, 5LX		
			0,109	2,8	4,53	6,75	5L, 5LX		
			0,125	3,2	5,17	7,70	5L, 5LX		
			0,141	3,6	5,81	8,65	5L, 5LX		
			0,156	4,0	6,40	9,53	5L, 5LX		
			0,172	4,4	7,03	10,5	5L, 5LX		
			0,188	4,8	7,65	11,4	5L, 5LX		
			0,226	5,7	9,11	13,6	5L, 5LX	STD	40
			0,250	6,4	10,00	14,9	5L, 5LX		
			0,281	7,1	11,20	16,6	5L, 5LX		
			0,318	8,1	12,50	18,6	5L, 5LX	XS	80
4	4,5	114,30	0,083	2,1	3,92	5,84	5L, 5LS, 5LX		
			0,109	2,8	5,11	7,61	5L, 5LS		
			0,125	3,2	5,84	8,70	5L, 5LS, 5LX		
			0,141	3,6	6,56	9,77	5L, 5LS, 5LX		
			0,156	4,0	7,24	10,8	5L, 5LS, 5LX		
			0,172	4,4	7,95	11,8	5L, 5LS, 5LX		
			0,188	4,8	8,66	12,9	5L, 5LS, 5LX		
			0,203	5,2	9,32	13,9	5L, 5LS, 5LX		
			0,219	5,6	10,00	14,9	5L, 5LS, 5LX		
			0,237	6,0	10,80	16,1	5L, 5LS, 5LX	STD	40
			0,250	6,4	11,40	16,9	5L, 5LS, 5LX		
			0,281	7,1	12,70	18,9	5L, 5LS, 5LX		
			0,312	7,9	14,00	20,8	5L, 5LS, 5LX		
			0,337	8,6	15,00	22,3	5L, 5LS, 5LX	XS	80
			0,438	11,1	19,00	28,3	5L, 5LS, 5LX		120
			0,531	13,5	22,50	33,5	5L, 5LS, 5LX		160
			0,674	17,1	27,50	41,0	5L, 5LS, 5LX	XXS	

Size in.	Outside Diameter in.	Outside Diameter mm	Wall Thickness in.	Wall Thickness mm	Weight lb/ft	Weight kg/m	Identification API	STD XS; XXS	Schedule No
5	5,563	141,30	0,083	2,1	4,86	7,24	5L, 5LS		
			0,125	3,2	7,26	10,8	5L, 5LS		
			0,156	4,0	9,01	13,4	5L, 5LS		
			0,188	4,8	10,80	16,1	5L, 5LS		
			0,219	5,6	12,50	18,6	5L, 5LS		
			0,258	6,6	14,60	21,8	5L, 5LS	STD	40
			0,281	7,1	15,80	23,6	5L, 5LS		
			0,312	7,9	17,50	26,1	5L, 5LS		
			0,344	8,7	19,20	28,6	5L, 5LS		
			0,375	9,5	20,80	31,0	5L	XS	80
			0,500	12,7	27,00	40,3	5L, 5LS		120
			0,625	15,9	33,00	49,1	5L, 5LS		160
			0,750	19,0	38,60	57,4	5L	XXS	
6	6,625	168,30	0,083	2,1	5,80	8,64	5L, 5LS, 5LX		
			0,109	2,8	7,59	11,3	5L, 5LS, 5LX		
			0,125	3,2	8,68	12,0	5L, 5LS, 5LX		
			0,141	3,6	9,76	14,5	5L, 5LS, 5LX		
			0,156	4,0	10,80	16,1	5L, 5LS, 5LX		
			0,172	4,4	11,80	17,6	5L, 5LS, 5LX		
			0,188	4,8	12,90	19,2	5L, 5LS, 5LX		
			0,203	5,2	13,90	20,7	5L, 5LS, 5LX		
			0,219	5,6	15,00	22,3	5L, 5LS, 5LX		
			0,250	6,4	17,0	25,4	5L, 5LS, 5LX		
			0,280	7,1	19,0	28,3	5L, 5LS, 5LX	STD	40
			0,312	7,9	21,0	31,3	5L, 5LS, 5LX		
			0,344	8,7	23,1	34,4	5L, 5LS, 5LX		
			0,375	9,5	25,0	37,3	5L, 5LS, 5LX		
			0,432	11,0	28,6	42,6	5L, 5LS, 5LX	XS	80
			0,500	12,7	32,7	48,7	5L, 5LS, 5LX		
			0,562	14,3	36,4	54,2	5L, 5LS, 5LX		120
			0,625	15,9	40,0	59,6	5L, 5LS, 5LX		
			0,719	18,3	45,4	67,6	5L, 5LS, 5LX		160
			0,864	21,9	53,2	79,2	5L	XXS	
8	8,625	219,10	0,125	3,2	11,4	19,9	5L, 5LS, 5LX		
			0,156	4,0	14,1	21,0	5L, 5LS, 5LX		
			0,188	4,8	16,9	25,2	5L, 5LS, 5LX		
			0,203	5,2	18,3	27,3	5LS, 5LX		
			0,219	5,6	19,7	29,3	5L, 5LS, 5LX		
			0,250	6,4	22,4	33,3	5L, 5LS, 5LX		20
			0,277	7,0	24,7	36,8	5L, 5LS, 5LX		30
			0,312	7,9	27,7	41,3	5L, 5LS, 5LX		
			0,322	8,2	28,6	42,5	5L, 5LS, 5LX	STD	40
			0,344	8,7	30,4	45,3	5L, 5LS, 5LX		
			0,375	9,5	33,0	49,2	5L, 5LS, 5LX		
			0,406	10,3	35,7	53,1			60
			0,438	11,1	38,3	57,0	5L, 5LS, 5LX		
			0,500	12,7	43,4	64,6	5L, 5LS, 5LX	XS	80
			0,562	14,3	48,4	72,1	5L, 5LS, 5LX		
			0,594	15,1	50,9	75,8			100
			0,625	15,9	53,4	79,5	5L, 5LS, 5LX		
			0,719	18,3	60,7	90,4	5L, 5LS, 5LX		120
			0,812	20,6	67,8	101,0			140
			0,875	22,6	72,4	108,0	5L, 5LS, 5LX	XXS	
			0,906	23,0	74,4	111,0			160

Size	Outside Diameter		Wall Thickness		Weight		Identification		
in.	in.	mm	in.	mm	In/ft	kg/m	API	STD XS; XXS	Schedule No
10	10,750	2730	0,156	4,0	17,6	26,3	5L, 5LS, 5LX		
			0,188	4,8	21,2	31,6	5L, 5LS, 5LX		
			0,203	5,2	22,9	34,1	5L, 5LS, 5LX		
			0,219	5,6	24,6	36,7	5L, 5LS, 5LX		
			0,250	6,4	28,0	41,8	5L, 5LS, 5LX		20
			0,279	7,1	31,2	46,5	5L, 5LS, 5LX		
			0,307	7,8	34,2	51,0	5L, 5LS, 5LX		30
			0,344	8,7	38,2	56,9	5L, 5LS, 5LX		
			0,365	9,3	40,5	60,3	5L, 5LS, 5LX	STD	40
			0,438	11,1	48,2	71,8	5L, 5LS, 5LX		
			0,500	12,7	54,7	81,5	5L, 5LS, 5LX	XS	60
			0,562	14,3	61,2	91,1	5L, 5LS, 5LX		
			0,594	15,1	64,4	95,8			80
			0,625	15,9	67,7	101,0	5L, 5LS, 5LX		
			0,719	18,3	77,0	115,0	5L, 5LS, 5LX		100
			0,812	20,6	86,2	128,0	5L, 5LS		
			0,844	21,4	89,3	133,0			120
			1,000	25,4	104,1	155,0		XXS	140
			1,125	28,6	115,6	172,0			160
12	12,750	323,80	0,172	4,4	23,1	34,4	5L, 5LS, 5LX		
			0,188	4,8	25,2	37,6	5L, 5LS, 5LX		
			0,203	5,2	27,2	40,5	5LS, 5LX		
			0,219	5,6	29,3	43,7	5L, 5LS, 5LX		
			0,250	6,4	33,4	49,7	5L, 5LS, 5LX		20
			0,281	7,1	37,4	55,7	5L, 5LS, 5LX		
			0,312	7,9	41,4	61,7	5L, 5LS, 5LX		
			0,330	8,4	43,8	65,2	5L, 5LS, 5LX		30
			0,344	8,7	45,6	67,9	5L, 5LS, 5LX		
			0,375	9,5	49,6	73,8	5L, 5LS, 5LX	STD	
			0,406	10,3	53,5	79,7	5LS, 5LX		40
			0,438	11,1	57,6	85,8	5L, 5LS, 5LX		
			0,500	12,7	65,4	97,4	5L, 5LS, 5LX	XS	
			0,562	14,3	73,1	109,0	5L, 5LS, 5LX		60
			0,625	15,9	80,9	121,0	5L, 5LS, 5LX		
			0,688	17,5	88,6	132,0	5L, 5LS, 5LX		80
			0,750	19,0	96,1	143,0	5L, 5LS, 5LX		
			0,812	20,6	104	154	5L, 5LS, 5LX		
			0,844	21,4	107	160			100
			0,875	22,2	111	165	5L, 5LS, 5LX		
			1,000	25,4	125	187		XXS	120
			1,125	28,6	140	208			140
			1,312	33,3	160	239			160
14	14,000	355,60	0,188	4,8	27,7	41,3	5L, 5LS, 5LX		
			0,203	5,2	29,9	44,6	5L, 5LS		
			0,210	5,3	30,9	46,1	5LS, 5LX		
			0,219	5,6	32,2	48,0	5L, 5LS, 5LX		
			0,250	6,4	36,7	54,7	5L, 5LS, 5LX		10
			0,281	7,1	41,2	61,3	5L, 5LS, 5LX		
			0,312	7,9	45,6	67,9	5L, 5LS, 5LX		20
			0,344	8,7	50,2	74,7	5L, 5LS, 5LX		
			0,375	9,5	54,6	81,3	5L, 5LS, 5LX	STD	30
			0,406	10,3	58,9	87,8	5LS, 5LX		
			0,438	11,1	63,4	94,5	5L, 5LS, 5LX		40
			0,469	11,9	67,8	101	5LS, 5LX		
			0,500	12,7	72,1	107	5L, 5LS, 5LX	XS	

Size	Outside Diameter		Wall Thickness		Weight		Identification		
in.	in.	mm	in.	mm	In/ft	kg/m	API	STD XS; XXS	Schedule No
			0,562	14,3	80,7	120	5L, 5LS, 5LX		
			0,594	15,1	85,0	127			60
			0,625	15,9	89,3	133	5L, 5LS, 5LX		
			0,688	17,5	97,8	146	5L, 5LS, 5LX		
			0,750	19,0	106	158	5L, 5LS, 5LX		80
			0,812	20,6	114	170	5L, 5LS, 5LX		
			0,875	22,2	123	183	5L, 5LS, 5LX		
			0,938	23,8	131	195	5L, 5LS, 5LX		100
			1,094	27,8	151	224			120
			1,250	31,8	170	253			140
			1,406	35,7	189	281			160
			2,000	50,8	256	381			
			2,125	54,0	270	401			
			2,200	55,9	277	413			
			2,500	63,5	307	457			
16	16,000	406,40	0,188	4,8	31,8	47,3	5L, 5LS, 5LX		
			0,203	5,2	34,2	51,0	5L, 5LS, 5LX		
			0,219	5,6	36,9	55,0	5L, 5LS, 5LX		
			0,250	6,4	42,0	62,6	5L, 5LS, 5LX		10
			0,281	7,1	47,2	70,3	5L, 5LS, 5LX		
			0,312	7,9	52,3	77,9	5L, 5LS, 5LX		20
			0,344	8,7	57,7	85,7	5L, 5LS, 5LX		
			0,375	9,5	62,6	93,2	5L, 5LS, 5LX	STD	30
			0,406	10,3	67,6	101	5LS, 5LX		
			0,438	11,1	72,8	108	5L, 5LS, 5LX		
			0,469	11,9	77,8	116	5LS, 5LX		
			0,500	12,7	82,8	123	5L, 5LS, 5LX	XS	40
			0,562	14,3	92,7	138	5L, 5LS, 5LX		
			0,625	15,0	103	153	5L, 5LS, 5LX		
			0,656	16,7	108	160			60
			0,688	17,5	113	168	5L, 5LS, 5LX		
			0,750	19,0	122	182	5L, 5LS, 5LX		
			0,812	20,6	132	196	5L, 5LS, 5LX		
			0,844	21,4	137	203			80
			0,875	22,2	141	211	5L, 5LS, 5LX		
			0,938	23,8	151	225	5L, 5LS, 5LX		
			1,000	25,4	160	239	5L, 5LS, 5LX		
			1,031	26,2	165	245			100
			1,062	26,9	169	253	5L, 5LS, 5LX		
			1,125	28,6	179	266	5L, 5LS, 5LX		
			1,219	31,0	192	286			120
			1,438	36,5	224	333			140
			1,594	40,5	245	365			160
18	18,000	457,20	0,188	4,8	35,8	53,3	5L, 5LS, 5LX		
			0,219	5,6	41,6	62,0	5L, 5LS, 5LX		
			0,250	6,4	47,4	70,6	5L, 5LS, 5LX		10
			0,281	7,1	53,2	79,2	5L, 5LS, 5LX		
			0,312	7,9	58,9	87,8	5L, 5LS, 5LX		20
			0,344	8,7	64,9	96,6	5L, 5LS, 5LX		
			0,375	9,5	70,6	105	5L, 5LS, 5LX	STD	
			0,406	10,3	76,3	114	5LS, 5LX		
			0,438	11,1	82,2	122	5L, 5LS, 5LX		30
			0,469	11,9	87,8	131	5LS, 5LX		
			0,500	12,7	93,4	139	5L, 5LS, 5LX	XS	
			0,562	14,3	105	156	5L, 5LS, 5LX		40

ANSI B 36.10

DIMENSIONS AND WEIGHTS OF SEAMLESS AND WELDED STEEL PIPE

Size	Outside Diameter		Wall Thickness		Weight		Identification		
in.	in.	mm	in.	mm	ln/ft	kg/m	API	STD XS; XXS	Schedule No
			0,625	15,9	116	173	5L, 5LS, 5LX		
			0,688	17,5	127	189	5L, 5LS, 5LX		
			0,750	19,0	138	206	5L, 5LS, 5LX		60
			0,812	20,6	149	222	5L, 5LS, 5LX		
			0,875	22,2	160	238	5L, 5LS, 5LX		
			0,938	23,8	171	255	5L, 5LS, 5LX		80
			1,000	25,4	182	270	5L, 5LS, 5LX		
			1,062	27,0	192	286	5L, 5LS, 5LX		
			1,125	28,6	203	302	5L, 5LS, 5LX		
			1,156	29,4	208	310			100
			1,187	30,8	213	317	5L, 5LS, 5LX		
			1,250	31,8	224	333	5L, 5LS, 5LX		
			1,375	34,9	244	363			120
			1,562	39,7	274	408			140
			1,781	45,2	309	459			160
20	20,000	508,00	0,219	5,6	46,3	68,9	5L, 5LS, 5LX		
			0,250	6,4	52,7	78,5	5L, 5LS, 5LX		10
			0,281	7,1	59,2	88,2	5L, 5LS, 5LX		
			0,312	7,9	65,6	97,7	5L, 5LS, 5LX		
			0,344	8,7	72,2	108	5L, 5LS, 5LX		
			0,375	9,5	78,6	117	5L, 5LS, 5LX	STD	20
			0,406	10,3	85,0	127	5LS, 5LX		
			0,438	11,1	91,5	136	5L, 5LS, 5LX		
			0,469	11,9	97,8	146	5LS, 5LX		
			0,500	12,7	104	155	5L, 5LS, 5LX	XS	30
			0,562	14,3	117	174	5L, 5LS, 5LX		
			0,594	15,1	123	183			40
			0,625	15,9	129	193	5L, 5LS, 5LX		
			0,688	17,5	142	211	5L, 5LS, 5LX		
			0,750	19,0	154	230	5L, 5LS, 5LX		
			0,812	20,6	166	248	5L, 5LS, 5LX		60
			0,875	22,2	179	266	5L, 5LS, 5LX		
			0,938	23,8	191	284	5L, 5LS, 5LX		
			1,000	25,4	203	302	5L, 5LS, 5LX		
			1,031	26,2	209	311			80
			1,062	27,0	215	320	5L, 5LS, 5LX		
			1,125	28,6	227	338	5L, 5LS, 5LX		
			1,187	30,2	238	355	5L, 5LS, 5LX		
			1,250	31,8	250	372	5L, 5LS, 5LX		
			1,281	32,5	256	381			100
			1,312	33,3	262	390	5L, 5LS, 5LX		
			1,375	34,9	274	407	5L, 5LS, 5LX		
			1,500	38,1	296	441			120
			1,750	44,4	341	508			140
			1,969	50,0	379	564			160
22	22,000	558,80	0,219	5,6	50,9	75,9	5L, 5LS, 5LX		
			0,250	6,4	58,1	86,5	5L, 5LS, 5LX		10
			0,281	7,1	65,2	97,1	5L, 5LS, 5LX		
			0,312	7,9	72,3	108	5L, 5LS, 5LX		
			0,344	8,7	79,6	118	5L, 5LS, 5LX		
			0,375	9,5	86,6	129	5L, 5LS, 5LX	STD	20
			0,406	10,3	93,6	139	5LS, 5LX		
			0,438	11,1	101	150	5L, 5LS, 5LX		
			0,469	11,9	108	161	5LS, 5LX		
			0,500	12,7	115	171	5L, 5LS, 5LX	XS	30
			0,562	14,3	129	192	5L, 5LS, 5LX		
			0,625	15,9	143	213	5L, 5LS, 5LX		
			0,688	17,5	157	233	5L, 5LS, 5LX		

Size	Outside Diameter		Wall Thickness		Weight		Identification		
in.	in.	mm	in.	mm	In/ft	kg/m	API	STD XS; XXS	Schedule No
			0,750	19,0	170	254	5L, 5LS, 5LX		
			0,812	20,6	184	274	5L, 5LS, 5LX		
			0,875	22,2	197	294	5L, 5LS, 5LX		60
			0,938	23,8	211	314	5L, 5LS, 5LX		
			1,000	25,4	224	334	5L, 5LS, 5LX		
			1,062	27,0	237	354	5L, 5LS, 5LX		
			1,125	28,6	251	374	5L, 5LS, 5LX		80
			1,187	30,2	264	393	5L, 5LS, 5LX		
			1,250	31,8	277	413	5L, 5LS, 5LX		
			1,312	33,3	290	432	5L, 5LS, 5LX		
			1,375	34,9	303	451	5L, 5LS, 5LX		100
			1,437	36,5	316	470	5L, 5LS, 5LX		
			1,500	38,1	328	489	5L, 5LS, 5LX		
			1,625	41,3	354	526			120
			1,875	47,6	403	600			140
			2,125	54,0	451	671			160
24	24,000	609,60	0,250	6,4	63,4	94,4	5L, 5LS, 5LX		10
			0,281	7,1	71,2	106	5L, 5LS, 5LX		
			0,312	7,9	78,9	118	5L, 5LS, 5LX		
			0,344	8,7	86,9	129	5L, 5LS, 5LX		
			0,375	9,5	94,6	141	5L, 5LS, 5LX	STD	20
			0,406	10,3	102	152	5LS, 5LX		
			0,438	11,1	110	164	5L, 5LS, 5LX		
			0,469	11,9	118	176	5LS, 5LX		
			0,500	12,7	125	187	5L, 5LS, 5LX	X S	
			0,562	14,3	141	210	5L, 5LS, 5LX		30
			0,625	15,9	156	232	5L, 5LS, 5LX		
			0,688	17,5	171	255	5L, 5LS, 5LX		40
			0,750	19,0	186	277	5L, 5LS, 5LX		
			0,812	20,6	201	300	5L, 5LS, 5LX		
			0,875	22,2	216	322	5L, 5LS, 5LX		
			0,938	23,8	231	344	5L, 5LS, 5LX		
			0,969	24,6	238	355			60
			1,000	25,4	246	366	5L, 5LS, 5LX		
			1,062	27,0	260	342	5L, 5LS, 5LX		
			1,125	28,6	275	409	5L, 5LS, 5LX		
			1,187	30,2	289	431	5L, 5LS, 5LX		
			1,219	31,0	297	441			80
			1,250	31,8	304	452	5L, 5LS, 5LX		
			1,312	33,3	318	474	5L, 5LS, 5LX		
			1,375	34,9	332	495	5L, 5LS, 5LX		
			1,437	36,5	346	516	5L, 5LS, 5LX		
			1,500	38,1	360	537	5L, 5LS, 5LX		
			1,531	38,9	367	547			100
			1,562	39,7	374	558	5L, 5LS, 5LX		
			1,812	46,0	430	639			120
			2,062	52,4	483	719			140
			2,344	59,5	542	807			160
26	26,000	660,40	0,250	6,4	68,8	102	5L, 5LS, 5LX		
			0,281	7,1	77,2	115	5L, 5LS, 5LX		
			0,312	7,9	85,6	128	5L, 5LS, 5LX		10
			0,344	8,7	94,3	140	5L, 5LS, 5LX		
			0,375	9,5	103	153	5L, 5LS, 5LX	STD	
			0,406	10,3	111	165	5 LS,5 LX		
			0,438	11,1	120	178	5L, 5LS, 5LX		
			0,469	11,9	128	190	5 LS,5 Lh		
			0,500	12,7	136	203	5L, 5LS, 5LX	XS	20
			0,562	14,3	153	227	5L, 5LS, 5LX		

Size	Outside Diameter		Wall Thickness		Weight		Identification		
in.	in.	mm	in.	mm	ln/ft	kg/m	API	STD XS; XXS	Schedule No
			0,625	15,9	169	252	5L, 5LS, 5LX		
			0,688	17,5	186	277	5L, 5LS, 5LX		
			0,750	19,0	202	301	5L, 5LS, 5LX		
			0,812	20,6	218	325	5L, 5LS, 5LX		
			0,875	22,2	235	350	5L, 5LS, 5LX		
			0,938	23,8	251	374	5L, 5LS, 5LX		
			1,000	25,4	267	398	5L, 5LS, 5LX		
28	28,000	711,20	0,250	6,4	74,1	110	5L, 5LS, 5LX		
			0,281	7,1	83,2	124	5L, 5LS, 5LX		
			0,312	7,9	92,3	137	5L, 5LS, 5LX		10
			0,344	8,7	102	151	5LS, 5LX		
			0,375	9,5	111	165	5L, 5LS, 5LX	STD	
			0,406	10,3	120	178	5LS, 5LX		
			0,438	11,1	129	192	5L, 5LS, 5LX		
			0,469	11,9	138	205	5LS, 5LX		
			0,500	12,7	147	219	5L, 5LS, 5LX	XS	20
			0,562	14,3	165	245	5L, 5LS, 5LX		
			0,625	15,9	183	272	5L, 5LS, 5LX		30
			0,688	17,5	201	299	5L, 5LS, 5LX		
			0,750	19,0	218	325	5L, 5LS, 5LX		
			0,812	20,6	236	351	5L, 5LS, 5LX		
			0,875	22,2	253	378	5L, 5LS, 5LX		
			0,938	23,8	271	404	5L, 5LS, 5LX		
			1,000	25,4	288	430	5L, 5LS, 5LX		
30	30,000	762	0,250	6,4	79,4	118	5L, 5LS, 5LX		
			0,281	7,1	89,2	133	5L, 5LS, 5LX		
			0,312	7,9	98,9	147	5L, 5LS, 5LX		10
			0,344	8,7	109	162	5LS, 5LX		
			0,375	9,5	119	177	5L, 5LS, 5LX	STD	
			0,406	10,3	128	191	5LS, 5LX		
			0,438	11,1	138	206	5L, 5LS, 5LX		
			0,469	11,9	148	220	5LS, 5LX		
			0,500	12,7	158	235	5L, 5LS, 5LX	XS	20
			0,562	14,3	177	263	5L, 5LS, 5LX		
			0,625	15,9	196	292	5L, 5LS, 5LX		30
			0,688	17,5	215	321	5L, 5LS, 5LX		
			0,750	19,0	234	349	5L, 5LS, 5LX		
			0,812	20,6	253	377	5L, 5LS, 5LX		
			0,875	22,2	272	405	5L, 5LS, 5LX		
			0,938	23,8	291	434	5L, 5LS, 5LX		
			1,000	25,4	310	461	5L, 5LS, 5LX		
32	32,000	812,80	0,250	6,4	84,8	126	5L, 5LS, 5LX		
			0,281	7,1	95,2	142	5L, 5LS, 5LX		
			0,312	7,9	106	157	5L, 5LS, 5LX		10
			0,344	8,7	116	173	5LS, 5LX		
			0,375	9,5	127	189	5L, 5LS, 5LX	STD	
			0,406	10,3	137	204	5LS, 5LX		
			0,438	11,1	148	220	5L, 5LS, 5LX		
			0,469	11,9	158	235	5LS, 5LX		
			0,500	12,7	168	251	5L, 5LS, 5LX	XS	20
			0,562	14,3	189	281	5L, 5LS, 5LX		
			0,625	15,9	209	312	5L, 5LS, 5LX		30
			0,688	17,5	230	343	5L, 5LS, 5LX		40
			0,750	19,0	250	373	5L, 5LS, 5LX		
			0,812	20,6	270	403	5L, 5LS, 5LX		
			0,875	22,2	291	433	5L, 5LS, 5LX		
			0,938	23,8	311	463	5L, 5LS, 5LX		
			1,000	25,4	331	493	5L, 5LS, 5LX		

Size	Outside Diameter		Wall Thickness		Weight		Identification		
in.	in.	mm	in.	mm	In/ft	kg/m	API	STD XS; XXS	Schedule No
34	34,000	863,60	0,250	6,4	90,1	134	5L, 5LS, 5LX		
			0,281	7,1	101	151	5L, 5LS, 5LX		
			0,312	7,9	112	167	5L, 5LS, 5LX		10
			0,344	8,7	124	184	5LS, 5LX		
			0,375	9,5	135	201	5L, 5LS, 5LX	STD	
			0,406	10,3	146	217	5LS, 5LX		
			0,438	11,1	157	234	5L, 5LS, 5LX		
			0,469	11,9	168	250	5LS, 5LX		
			0,500	12,7	179	266	5L, 5LS, 5LX	XS	20
			0,562	14,3	201	299	5L, 5LS, 5LX		
			0,625	15,9	223	332	5L, 5LS, 5LX		30
			0,688	17,5	245	365	5L, 5LS, 5LX		40
			0,750	19,0	266	397	5L, 5LS, 5LX		
			0,812	20,6	288	429	5L, 5LS, 5LX		
			0,875	22,2	310	461	5L, 5LS, 5LX		
			0,938	23,8	331	493	5L, 5LS, 5LX		
			1,000	25,4	352	525	5L, 5LS, 5LX		
36	36,000	914,40	0,250	6,4	95,4	142	5L, 5LS, 5LX		
			0,281	7,1	107	160	5L, 5LS, 5LX		
			0,312	7,9	119	177	5L, 5LS, 5LX		10
			0,344	8,7	131	195	5LS, 5LX		
			0,375	9,5	143	213	5L, 5LS, 5LX	STD	
			0,406	10,3	154	230	5LS, 5LX		
			0,438	11,1	166	248	5L, 5LS, 5LX		
			0,469	11,9	178	265	5LS, 5LX		
			0,500	12,7	190	282	5L, 5LS, 5LX	XS	20
			0,562	14,3	213	317	5L, 5LS, 5LX		
			0,625	15,9	236	352	5L, 5LS, 5LX		30
			0,688	17,5	259	386	5L, 5LS, 5LX		
			0,750	19,0	282	421	5L, 5LS, 5LX		40
			0,812	20,6	305	455	5L, 5LS, 5LX		
			0,875	22,2	328	489	5L, 5LS, 5LX		
			0,938	23,8	351	523	5L, 5LS, 5LX		
			1,000	25,4	374	557	5L, 5LS, 5LX		
38	38,000	965,20	0,312	7,9	126	187	5L, 5LS, 5LX		
			0,344	8,7	138	206	5L, 5LS, 5LX		
			0,375	9,5	151	224	5L, 5LS, 5LX		
			0,406	10,3	163	243	5L, 5LS, 5LX		
			0,438	11,1	176	262	5L, 5LS, 5LX		
			0,469	11,9	188	280	5L, 5LS, 5LX		
			0,500	12,7	200	298	5L, 5LS, 5LX		
			0,562	14,3	225	335	5L, 5LS, 5LX		
			0,625	15,9	249	372	5L, 5LS, 5LX		
			0,688	17,5	274	408	5L, 5LS, 5LX		
			0,750	19,0	298	444	5L, 5LS, 5LX		
			0,812	20,6	322	480	5L, 5LS, 5LX		
			0,875	22,2	347	517	5L, 5LS, 5LX		
			0,938	23,8	371	553	5L, 5LS, 5LX		
			1,000	25,4	395	589	5L, 5LS, 5LX		
40	40,000	1016	0,312	7,9	132	197	5L, 5LS, 5LX		
			0,344	8,7	146	217	5L, 5LS, 5LX		
			0,375	9,5	159	236	5L, 5LS, 5LX		
			0,406	10,3	172	256	5L, 5LS, 5LX		
			0,438	11,1	185	276	5L, 5LS, 5LX		
			0,469	11,9	198	295	5L, 5LS, 5LX		
			0,500	12,7	211	314	5L, 5LS, 5LX		
			0,562	14,3	237	353	5L, 5LS, 5LX		

Size in.	Outside Diameter in.	mm	Wall Thickness in.	mm	Weight lb/ft	kg/m	Identification API	STD XS; XXS	Schedule No
			0,625	15,9	263	391	5L, 5LS, 5LX		
			0,688	17,5	289	430	5L, 5LS, 5LX		
			0,050	19,0	314	468	5L, 5LS, 5LX		
			0,812	20,6	340	506	5L, 5LS, 5LX		
			0,875	22,2	366	545	5L, 5LS, 5LX		
			0,938	23,8	391	583	5L, 5LS, 5LX		
			1,000	25,4	417	620	5L, 5LS, 5LX		
42	42,000	1066,80	0,344	8,7	153	228	5L, 5LS, 5LX		
			0,375	9,5	167	248	5L, 5LS, 5LX		
			0,406	10,3	180	269	5L, 5LS, 5LX		
			0,438	11,1	194	290	5L, 5LS, 5LX		
			0,460	11,9	208	310	5L, 5LS, 5LX		
			0,500	12,7	222	330	5L, 5LS, 5LX		
			0,562	14,3	249	370	5L, 5LS, 5LX		
			0,625	15,9	276	411	5L, 5LS, 5LX		
			0,688	17,5	304	452	5L, 5LS, 5LX		
			0,750	19,0	330	492	5L, 5LS, 5LX		
			0,812	20,6	357	532	5L, 5LS, 5LX		
			0,875	22,2	384	572	5L, 5LS, 5LX		
			0,938	23,8	411	615	5L, 5LS, 5LX		
			1,000	25,4	438	652	5L, 5LS, 5LX		
44	44,000	1117,60	0,344	8,7	160	239	5L, 5LS, 5LX		
			0,375	9,5	175	260	5L, 5LS, 5LX		
			0,406	10,3	189	282	5L, 5LS, 5LX		
			0,438	11,1	204	304	5L, 5LS, 5LX		
			0,469	11,9	218	325	5L, 5LS, 5LX		
			0,500	12,7	232	346	5L, 5LS, 5LX		
			0,562	14,3	261	388	5L, 5LS, 5LX		
			0,625	15,9	290	431	5L, 5LS, 5LX		
			0,688	17,5	318	474	5L, 5LS, 5LX		
			0,750	19,0	346	516	5L, 5LS, 5LX		
			0,812	20,6	375	558	5L, 5LS, 5LX		
			0,875	22,2	403	600	5L, 5LS, 5LX		
			0,938	23,8	431	643	5L, 5LS, 5LX		
			1,000	25,4	474	684	5L, 5LS, 5LX		
46	46,000	1168,40	0,344	8,7	168	250	5L, 5LS, 5LX		
			0,375	9,5	183	272	5L, 5LS, 5LX		
			0,406	10,3	198	294	5L, 5LS, 5LX		
			0,438	11,1	213	317	5L, 5LS, 5LX		
			0,469	11,9	228	340	5L, 5LS, 5LX		
			0,500	12,7	243	362	5L, 5LS, 5LX		
			0,562	14,3	273	406	5L, 5LS, 5LX		
			0,625	15,9	303	451	5L, 5LS, 5LX		
			0,688	17,5	333	496	5L, 5LS, 5LX		
			0,750	19,0	362	540	5L, 5LS, 5LX		
			0,812	20,6	392	584	5L, 5LS, 5LX		
			0,875	22,2	422	628	5L, 5LS, 5LX		
			0,938	23,8	451	602	5L, 5LS, 5LX		
			1,000	25,4	481	716	5L, 5LS, 5LX		

Size	Outside Diameter		Wall Thickness		Weight		Identification		
in.	in.	mm	in.	mm	ln/ft	kg/m	API	STD XS; XXS	Schedule No
48	48,000	1219,20	0,344	8,7	175	261	5L, 5LS, 5LX		
			0,375	9,5	191	284	5L, 5LS, 5LX		
			0,406	10,3	206	307	5L, 5LS, 5LX		
			0,438	11,1	222	331	5L, 5LS, 5LX		
			0,469	11,9	238	355	5L, 5LS, 5LX		
			0,500	12,7	254	378	5L, 5LS, 5LX		
			0,562	14,3	285	424	5L, 5LS, 5LX		
			0,625	15,9	316	471	5L, 5LS, 5LX		
			0,688	17,5	348	518	5L, 5LS, 5LX		
			0,750	19,0	378	564	5L, 5LS, 5LX		
			0,812	20,6	409	610	5L, 5LS, 5LX		
			0,875	22,2	440	656	5L, 5LS, 5LX		
			0,938	23,8	471	702	5L, 5LS, 5LX		
			1,000	25,4	502	748	5L, 5LS, 5LX		



	OD mm	STD 5s	XS 5	10s	10	20	30	40s	40	60	80s	80	100	120	140	160	XXS
1/8	10.3							1.73	Identical with STD and 40s		2.41	Identical with XS and 80s					
								0.37			**0.47**						
1/4	13.7							2.24			3.02						
								0.64			**0.82**						
3/8	17.2							2.31			3.20						
								0.87			**1.12**						
1/2	21.3	1.65	1.65	2.11	2.11			2.77			3.73					4.75	7.47
		0.81	**0.81**	**1.02**	**1.02**			**1.29**			**1.64**					**1.97**	**2.59**
3/4	26.7	1.65	1.65	2.11	2.11			2.87			3.91					5.54	7.82
		1.03	**1.03**	**1.30**	**1.30**			**1.71**			**2.23**					**2.93**	**3.69**
1	33.4	1.65	1.65	2.77	2.77			3.38			4.55					6.35	9.09
		1.31	**1.31**	**2.13**	**2.13**			**2.54**			**3.29**					**4.30**	**5.53**
1 1/4	42.2	1.65	1.65	2.77	2.77			3.56			4.85					6.35	9.70
		1.67	**1.67**	**2.73**	**2.73**			**3.44**			**4.53**					**5.69**	**7.88**
1 1/2	48.3	1.65	1.65	2.77	2.77			3.68			5.08					7.14	10.16
		1.93	**1.93**	**3.16**	**3.16**			**4.11**			**5.49**					**7.35**	**9.69**
2	60.3	1.65	1.65	2.77	2.77			3.91			5.54					8.71	11.07
		2.42	**2.42**	**3.99**	**3.99**			**5.52**			**7.60**					**11.26**	**13.65**
2 1/2	73.0	2.11	2.11	3.05	3.05			5.16			7.01					9.53	14.02
		3.75	**3.75**	**5.34**	**5.34**			**8.77**			**11.59**					**15.15**	**20.72**
3	88.9	2.11	2.11	3.05	3.05			5.49			7.62					11.13	15.24
		4.59	**4.59**	**6.56**	**6.56**			**11.47**			**15.51**					**21.67**	**28.11**
3 1/2	101.6	2.11	2.11	3.05	3.05			5.74			8.08						16.15
		5.25	**5.25**	**7.53**	**7.53**			**13.78**			**18.92**						**34.56**
4	114.3	2.11	2.11	3.05	3.05			6.02			8.56			11.13		13.49	17.12
		5.93	**5.93**	**8.50**	**8.50**			**16.32**			**22.66**			**28.75**		**34.05**	**41.66**
5	141.3	2.77	2.77	3.40	3.40			6.55			9.53			12.70		15.88	19.05
		9.61	**9.61**	**11.74**	**11.74**			**22.10**			**31.44**			**40.90**		**49.87**	**58.31**
6	168.3	2.77	2.77	3.40	3.40			7.11			10.97			14.27		18.24	21.95
		11.47	**11.47**	**14.04**	**14.04**			**28.69**			**43.21**			**55.03**		**68.53**	**80.43**
8	219.1	2.77	2.77	3.76	3.76	6.35	7.04	8.18		10.81	12.70		15.06	18.24	20.62	23.01	22.23
		15.00	**15.00**	**20.27**	**20.27**	**33.82**	**37.38**	**43.20**		**53.90**	**65.63**		**76.93**	**91.73**	**102.47**	**112.97**	**109.57**
10	273.1	3.40	3.40	4.19	4.19	6.35	7.80	9.27		12.70	12.70	15.06	18.24	21.41	25.40	28.58	25.40
		22.95	**22.95**	**28.20**	**28.20**	**42.41**	**51.81**	**61.22**		**82.80**	**82.80**	**97.27**	**116.38**	**134.90**	**157.51**	**174.95**	**157.51**
12	323.9	3.96	4.19	4.57	4.57	6.35	8.38	9.53	10.31	14.27	12.70	17.45	21.41	25.40	28.58	33.32	25.40
		31.72	**33.60**	**36.54**	**36.54**	**50.48**	**66.20**	**75.01**	**80.94**	**110.62**	**98.95**	**133.88**	**162.14**	**189.82**	**211.31**	**242.40**	**189.82**
14	355.6	3.96		4.78	6.35	7.92	9.53	9.53	11.13	15.06	12.70	19.05	23.80	27.76	31.75	35.71	
		34.86		**41.99**	**55.53**	**68.95**	**82.58**	**82.58**	**96.00**	**128.42**	**109.04**	**160.54**	**197.74**	**227.88**	**257.47**	**286.04**	
16	406.4	4.19		4.78	6.35	7.92	9.53	9.53	12.70	16.66	12.70	21.41	26.19	30.94	36.53	40.46	
		42.20		**48.07**	**63.61**	**79.03**	**94.70**	**94.70**	**125.20**	**206.40**	**249.34**	**290.88**	**338.32**	**370.74**			
18	457.2	4.19		4.78	6.35	7.92	11.13	9.53	14.27	19.05	12.70	23.80	29.36	34.93	39.67	45.24	
		47.46		**54.15**	**71.69**	**89.10**	**124.32**	**106.83**	**158.27**	**209.00**	**141.35**	**258.29**	**314.54**	**369.34**	**414.75**	**466.67**	
20	508.0	4.78		5.54	6.35	9.53	12.70	9.53	15.06	20.62	12.70	26.19	32.54	38.10	44.45	49.99	
		60.23		**69.70**	**79.76**	**118.93**	**157.51**	**118.93**	**185.89**	**251.65**	**157.51**	**315.97**	**387.41**	**448.30**	**515.94**	**573.31**	
22	558.8	4.78		5.54	6.35	9.53	12.70	9.53	15.88	22.23	12.70	28.57	34.92	41.27	47.62	53.97	
		65.95		**76.75**	**87.84**	**131.07**	**173.66**	**131.07**	**216.04**	**298.55**	**173.66**	**379.70**	**457.83**	**535.17**	**609.30**	**682.57**	
24	609.6	5.54		6.35	6.35	9.53	14.27	9.53	17.45	24.59	12.70	30.94	38.89	46.02	52.37	59.51	
		83.80		**95.92**	**95.92**	**143.20**	**212.72**	**143.20**	**258.74**	**360.21**	**189.82**	**448.30**	**555.76**	**649.44**	**730.72**	**819.70**	
26	660.4				7.92	12.70		9.53			12.70						
					129.40	**205.97**		**155.32**			**205.97**						
28	711.2				7.92	12.70	15.88	9.53			12.70						
					139.47	**222.13**	**276.48**	**167.44**			**222.13**						
30	762.0	6.35		7.92	7.92	12.70	15.88	9.53			12.70						
		120.15		**149.55**	**149.55**	**238.28**	**296.68**	**179.56**			**238.28**						
32	812.8				7.92	12.70	15.88	9.53	17.48		12.70						
					159.62	**254.44**	**316.88**	**191.69**	**348.11**		**254.44**						
34	863.6				7.92	12.70	15.88	9.53	17.48		12.70						
					169.64	**270.50**	**336.96**	**203.74**	**370.22**		**270.50**						
36	914.4				7.92	12.70	15.88	9.53	19.05		12.70						
					179.77	**286.75**	**357.28**	**215.93**	**427.09**		**286.75**						

1.65 = Wall thickness in mm **0.81** = kg/m

O.D. mm	Standard Wall thickness mm	weight kg/m	other weights in mm / Gewicht kg/m																		
			2	2,3	2,6	2,9	3,2	3,6	4	4,5	5	5,6	6,3	7,1	8	8,8	10	11	12,5	14,2	16
10,29*)	1,6	0,344	0,410	0,454	0,493	0,525	0,555	0,588	0,614												
13,5*)	1,8	0,522	0,571	0,639	0,703	0,762	0,817	0,883	0,940	0,996	1,05										
16	1,8	0,632	0,692	0,778	0,860	0,938	1,01	1,10	1,18	1,27	1,36	1,43	1,51								
17,2*)	1,8	0,688	0,754	0,850	0,942	1,03	1,11	1,21	1,31	1,41	1,50	1,60	1,70								
20	2	0,890		1,01	1,12	1,22	1,33	1,46	1,58	1,71	1,85	1,98	2,13	2,26	2,36	2,43					
21,3*)	2	0,962		1,09	1,21	1,33	1,44	1,59	1,72	1,87	2,01	2,17	2,34	2,49	2,62	2,71					
25	2	1,13		1,29	1,44	1,58	1,72	1,90	2,07	2,28	2,47	2,68	2,91	3,13	3,35	3,52	3,70				
26,9*)	2,3	1,41			1,57	1,73	1,89	2,09	2,28	2,48	2,70	2,94	3,21	3,48	3,72	3,92	4,17				
30	2,6	1,77				1,96	2,14	2,37	2,59	2,83	3,08	3,37	3,70	4,03	4,34	4,59	4,93				
31,8	2,6	1,88				2,08	2,27	2,52	2,76	3,02	3,30	3,60	3,97	4,33	4,68	4,97	5,37				
33,7*)	2,6	2,01				2,22	2,42	2,69	2,95	3,23	3,54	3,87	4,27	4,67	5,05	5,39	5,84	6,17			
38	2,6	2,29				2,53	2,77	3,08	3,38	3,71	4,07	4,47	4,95	5,43	5,91	6,33	6,91	7,36	7,90		
42,4*)	2,6	2,57				2,84	3,11	3,47	3,81	4,19	4,61	5,07	5,62	6,19	6,76	7,27	7,99	8,54	9,25	9,88	
44,5	2,6	2,70				2,99	3,28	3,65	4,02	4,42	4,87	5,35	5,95	6,56	7,17	7,72	8,51	9,11	9,90	10,6	
48,3*)	2,6	2,95				3,27	3,59	4,00	4,41	4,85	5,34	5,89	6,55	7,24	7,93	8,56	9,45	10,2	11,1	11,9	12,7
51	2,6	3,12				3,46	3,79	4,23	4,66	5,13	5,67	6,24	6,95	7,69	8,43	9,10	10,1	10,9	11,9	12,9	13,7
(54)	2,6	3,30				3,65	4,01	4,47	4,93	5,49	6,04	6,68	7,41	8,21	9,08	9,81	10,9	11,7	12,8	13,9	15,0
57	2,9	3,90					4,28	4,78	5,27	5,81	6,41	7,08	7,91	8,77	9,65	10,4	11,6	12,5	13,8	15,0	16,2
60,3*)	2,9	4,14					4,54	5,07	5,59	6,17	6,82	7,53	8,42	9,34	10,3	11,1	12,4	13,4	14,8	16,2	17,4
63,5	2,9	4,36					4,79	5,36	5,91	6,52	7,21	7,97	8,91	9,90	10,9	11,8	13,2	14,3	15,8	17,3	18,7
70	2,9	4,83					5,30	5,93	6,55	7,24	8,01	8,85	9,92	11,0	12,2	13,2	14,8	16,0	17,8	19,6	21,2
76,1*)	2,9	5,28					5,80	6,49	7,17	7,92	8,77	9,71	10,9	12,1	13,4	14,6	16,3	17,7	19,7	21,7	23,7
82,5	3,2	6,31						7,05	7,80	8,63	9,56	10,6	11,9	13,2	14,6	14,9	17,9	19,5	21,7	24,0	26,2
88,9*)	3,2	6,81						7,63	8,43	9,33	10,3	11,5	12,9	14,4	15,9	17,3	19,5	21,2	23,7	26,2	28,7
(95)	3,6	8,11							8,98	10,0	11,1	12,3	13,8	15,4	17,2	18,7	21,0	22,8	25,4	28,3	31,2
101,6*)	3,6	8,76							9,70	10,7	11,9	13,2	14,9	16,6	18,4	20,1	22,6	24,7	27,6	30,7	33,7
108	3,6	9,33							10,3	11,4	12,7	14,1	15,8	17,7	19,6	21,4	24,2	26,4	29,6	32,9	36,2
114,3*)	3,6	9,90							11,0	12,1	13,5	15,0	16,8	18,8	20,9	22,8	25,7	28,1	31,6	35,1	38,6
(121)	4	11,5								12,9	14,3	15,9	17,8	19,9	22,3	24,3	27,4	29,8	33,4	37,4	41,4
127	4	12,2								13,5	15,0	16,7	18,8	21,0	23,4	25,5	28,9	31,6	35,5	39,6	43,6
133	4	12,8								14,2	15,8	17,6	19,8	22,1	24,6	26,9	30,3	33,3	37,4	41,8	46,1
139,7*)	4	13,5								14,9	16,6	18,5	20,8	23,3	25,9	28,3	32,0	35,1	39,5	44,0	48,6
(146)	4,5	15,7									17,4	19,4	21,7	24,3	27,2	29,8	33,5	36,6	41,2	46,2	51,3
152,4	4,5	16,4									18,2	20,2	22,8	25,5	28,4	31,0	35,1	38,5	43,4	48,5	53,6
159	4,5	17,1									19,0	21,1	23,8	26,6	29,6	32,4	36,7	40,3	45,4	50,8	56,2
165,1	4,5	17,8									19,7	21,9	24,8	27,7	30,9	33,8	38,2	42,0	47,4	53,0	58,6
168,3*)	4,5	18,1									20,1	22,4	25,3	28,3	31,5	34,5	39,0	42,9	48,4	54,1	59,9
(171)	4,5	18,5									20,5	22,8	25,6	28,7	32,2	35,2	39,7	43,4	48,9	54,9	61,2
177,8	5	21,3										23,7	26,7	30,0	33,4	36,5	41,5	45,4	51,3	57,4	63,6
(191)	5,4	24,7											28,7	32,2	36,1	39,5	44,6	48,8	55,0	61,9	69,1
193,7*)	5,4	25,0											29,2	32,8	36,5	40,0	45,3	49,8	56,2	63,0	69,8
(216)	6	31,1											32,6	36,6	41,0	45,0	50,8	55,6	62,7	70,7	78,9
219,1*)	5,9	31,0											33,2	37,2	41,5	45,4	51,6	56,7	64,1	71,9	79,8
(241)	6,3	36,5												41,0	46,0	50,4	57,0	62,4	70,4	79,4	88,8
244,5*)	6,3	37,1												41,7	46,5	50,9	57,8	63,6	72,0	80,8	89,8
267	6,3	40,6												45,6	50,9	55,8	63,4	69,7	79,0	88,7	98,6
273*)	6,3	41,6												46,7	52,1	57,1	64,9	71,4	80,9	90,9	101
(292)	7	49,2													26,0	61,5	69,5	76,2	86,2	97,3	109
298,5	7,1	51,1													57,1	62,6	71,1	78,3	88,8	99,8	111
(318)	7,5	57,4													61,2	67,1	76,0	83,3	94,2	106	119
323,9*)	7,1	55,6													62,1	68,1	77,4	85,3	96,7	109	121
(343)	8	66,1														72,5	82,1	90,1	102	115	129
355,6*)	8	68,3														74,9	85,2	93,9	107	120	133
368	8	70,8														77,7	88,3	97,3	110	124	138
(394)	9	85,5															94,7	104	118	139	149
406,4*)	8,8	85,9															97,8	108	122	138	153
419	10	101																111	126	142	158
(445)	10	107																118	133	151	169
457,2	10	110																122	138	156	173
(470)	10,5	119																	141	160	179
(495)	11	131																	149	168	189
508*)	11	135																	154	173	193
(521)	11,5	144																		177	199
(546)	12	158																		186	209
558,8	12,5	170																		191	213
(572)	12,5	172																		195	219
609,6	12,5	185																		209	233
(622)	13	195																		213	239
660,4	14,2	227																			253

Sizes not enclosed within the bold lines are not covered by DIN 2448.

* Up to 139.7 mm incl., these outside diameters are in conformity with threaded pipe to ISO Recommendation R7, from 168.3 mm in conformity with ANSI B 2.1, API Std 5A, 5L or 5LX (without threads).

This marked size range acc. DIN 2448

other weights in mm / Gewicht kg/m

17,5	20	22,2	25	28	30	32	36	40	45	50	55	60	65	70	75	80	85	90	100	110	120	O.D. mm
																						10,29*)
																						13,5*)
																						16
																						17,2*)
																						20
																						21,3*)
																						25
																						26,9*)
																						30
																						31,8
																						33,7*)
																						38
																						42,4*)
																						44,5
																						48,3*)
																						51
																						(54)
																						57
18,5																						60,3*)
19,8																						63,5
22,6																						70
25,3	27,7																					76,1*)
28,0	30,8	33,0	35,6																			82,5
30,8	34,0	36,5	39,6																			88,9*)
33,4	37,0	39,9	43,2	46,3																		(95)
36,2	40,2	43,5	47,5	50,8																		101,6*)
39,0	43,4	47,0	51,4	55,2	57,6																	108
41,7	46,5	50,4	55,3	59,5	62,3	64,9																114,3*)
44,7	49,8	54,1	59,2	64,2	67,3	70,2																(121)
47,2	52,8	57,4	63,2	68,3	71,7	74,9	80,8															127
49,9	55,7	60,8	67,1	72,5	76,3	79,8	86,3	91,8														133
52,7	59,0	64,3	71,1	77,0	81,1	85,0	92,1	98,2	105													139,7*)
55,5	62,1	67,8	74,6	81,5	85,8	90,0	97,7	105	112													(146)
58,1	65,3	71,3	79,0	85,8	90,5	95	103	111	119													152,4
60,9	68,6	74,8	83,0	90,3	95,3	100	109	117	126	134	141											159
63,6	71,6	78,2	86,9	94,5	99,9	105	115	123	133	142	149											165,1
65,0	73,1	80,0	88,9	96,7	102	108	117	126	137	146	154											168,3*)
66,2	74,5	81,5	90,9	98,7	104	110	120	129	140	149	157											(171)
69,1	77,8	85,2	94,8	103	109	115	126	136	147	158	167											177,8
74,9	84,3	92,4	102	113	119	125	138	149	162	174	184											(191)
75,9	85,7	93,9	105	114	121	128	140	151	165	177	188											193,7*)
85,7	96,7	106	118	130	138	145	160	174	190	205	218											(216)
86,9	98,2	108	120	132	140	148	163	176	193	208	223											219,1*)
96,5	109	120	133	147	156	165	182	198	218	236	252	268	282	295								(241)
97,8	111	122	136	149	159	168	185	201	221	240	257	273	288	301								244,5*)
107	122	134	150	165	175	185	205	223	246	267	287	306	323	340	355	368	381					267
110	125	137	154	169	180	190	211	229	253	275	296	315	333	350	366	381	394					273*)
118	134	148	165	182	194	205	227	249	274	298	322	343	364	383	401	418	434	448				(292)
121	137	151	170	187	198	210	233	255	281	306	330	353	374	394	413	431	447	462				298,5
130	147	162	181	200	213	226	250	274	303	330	357	382	406	428	449	469	488	505				(318)
132	150	165	186	204	217	230	256	280	309	338	365	390	415	438	460	481	500	519				323,9*)
140	159	176	196	218	232	245	273	299	331	361	391	419	446	471	496	519	541	561				(343)
146	166	183	203	226	241	255	284	311	344	377	408	437	466	493	519	544	567	589	630			355,6*)
151	172	189	213	235	250	265	295	323	358	392	425	456	486	514	542	568	593	617	661			368
162	184	204	228	253	269	286	318	349	387	424	460	494	527	559	590	620	648	675	725			(394)
168	191	210	237	261	278	295	329	361	401	439	477	512	547	580	613	644	673	702	755	804	847	406,4*)
173	197	217	245	270	288	305	340	373	415	455	494	531	567	602	636	669	700	730	786	838	885	419
184	210	231	259	288	307	326	363	400	444	487	529	570	609	647	684	720	755	788	851	909	962	(445)
189	216	238	268	296	316	335	374	411	457	502	546	587	629	668	707	744	780	815	881	942	998	457,2
195	222	245	274	305	326	346	385	424	472	518	563	607	649	691	731	769	807	843	912	977	1036	(470)
206	234	259	290	323	344	365	408	449	499	549	597	644	689	734	777	819	859	899	974	1045	1110	(495)
211	241	266	300	331	353	375	419	461	513	565	615	662	710	756	801	844	886	927	1006	1080	1148	508*)
217	247	273	306	340	363	386	431	474	528	581	632	682	731	779	825	870	914	957	1038	1115	1187	(521)
228	259	287	321	358	382	406	453	499	556	612	666	719	771	822	871	919	966	1012	1100	1183	1261	(546)
233	266	294	331	366	391	416	464	511	570	627	684	737	791	843	894	944	993	1040	1131	1218	1298	558,8
239	272	301	337	376	401	426	476	525	585	644	701	758	813	867	919	971	1021	1070	1164	1253	1337	(572)
255	291	322	363	401	428	456	509	561	626	690	753	813	873	931	988	1044	1099	1153	1256	1355	1449	609,6
261	297	328	368	410	438	466	520	574	640	705	769	832	893	953	1012	1069	1126	1181	1287	1389	1485	(622)
277	316	349	395	436	466	496	555	611	682	753	822	888	954	1019	1082	1145	1206	1265	1381	1493	1599	660,4

[1] Sizes given in parentheses are complementary sizes.
[2] Usually, standard sizes are available from stock. In general, seamless tubing and pipe are only manufactured in those sizes for which weights are indicated. Other sizes upon request. English units are conversions of the metric ones.
[3] Minimum wall thickness see DIN 2440.

Outside Diameter mm	Standard Wall Thickness mm	Standard Wall Thickness in.	Weight kg/m	1,8 0,072	2 0,080	2,3 0,092	2,6 0,104	2,9 0,116	3,2 0,128	3,6 0,144	4 0,160	4,5 0,176	5 0,192	5,6 0,219	6,3 0,250
				Other Wall Thicknesses mm/in. – Weight kg/m											
10,2*)	1,6	0,064	0,344	0,378	0,410	0,454	0,493	0,525							
13,5*)	1,8	0,072	0,522	0,522	0,571	0,639	0,703	0,762							
16	1,8	0,072	0,632	0,632	0,692	0,778	0,860	0,938	1,01	1,10					
17,2*)	1,8	0,072	0,688	0,688	0,754	0,850	0,942	1,03	1,11	1,21					
21,3*)	2	0,080	0,962	0,874	0,962	1,09	1,21	1,33	1,44	1,59	1,72	1,87			
25	2	0,080	1,13	1,03	1,13	1,29	1,44	1,58	1,72	1,90	2,07	2,28			
26,9*)	2	0,080	1,24	1,12	1,24	1,41	1,57	1,73	1,89	2,09	2,28	2,48	2,70		
30	2	0,080	1,39		1,39	1,59	1,77	1,96	2,14	2,37	2,59	2,83	3,08		
31,8	2	0,080	1,48		1,48	1,68	1,88	2,08	2,27	2,52	2,76	3,02	3,30		
33,7*)	2	0,080	1,57		1,57	1,79	2,01	2,22	2,42	2,69	2,95	3,23	3,54		
38	2	0,080	1,79		1,79	2,04	2,29	2,53	2,77	3,08	3,38	3,71	4,07		
42,4*)	2	0,080	2,01		2,01	2,29	2,57	2,84	3,11	3,47	3,81	4,19	4,61	5,07	
44,5	2	0,080	2,11		2,11	2,41	2,70	2,99	3,28	3,65	4,02	4,42	4,87	5,35	
48,3*)	2,3	0,092	2,63		2,30	2,63	2,95	3,27	3,59	4,00	4,41	4,85	5,34	5,89	
51	2,3	0,092	2,78		2,43	2,78	3,12	3,46	3,79	4,23	4,66	5,13	5,67	6,24	
57	2,3	0,092	3,13			3,13	3,52	3,90	4,28	4,78	5,27	5,81	6,41	7,08	
60,3*)	2,3	0,092	3,31			3,31	3,73	4,14	4,54	5,07	5,59	6,17	6,82	7,53	
63,5	2,3	0,092	3,50			3,50	3,93	4,36	4,79	5,36	5,91	6,52	7,21	7,97	
70	2,6	0,104	4,35			3,86	4,35	4,83	5,30	5,93	6,55	7,24	8,01	8,85	9,92
76,1*)	2,6	0,104	4,75			4,22	4,75	5,28	5,80	6,49	7,17	7,92	8,77	9,71	10,9
88,9*)	2,9	0,116	6,20				5,57	6,20	6,81	7,63	8,43	9,33	10,3	11,5	12,9
101,6*)	2,9	0,116	7,11					7,11	7,82	8,76	9,70	10,7	11,9	13,2	14,9
108	2,9	0,116	7,57						8,33	9,33	10,3	11,4	12,7	14,1	15,8
114,3*)	3,2	0,128	8,83						8,83	9,90	11,0	12,1	13,5	15,0	16,8
127	3,2	0,128	9,84						9,84	11,0	12,2	13,5	15,0	16,7	18,8
133	3,6	0,144	11,6						10,3	11,6	12,8	14,2	15,8	17,6	19,8
139,7*)	3,6	0,144	12,2						10,9	12,2	13,5	14,9	16,6	18,5	20,8
152,4	4	0,160	14,7						11,9	13,3	14,7	16,4	18,2	20,2	22,8
159	4	0,160	15,4						12,4	13,9	15,4	17,1	19,0	21,1	23,8
165,1	4	0,160	16,0						12,9	14,4	16,0	17,8	19,7	21,9	24,8
168,3*)	4	0,160	16,3						13,1	14,7	16,3	18,1	20,1	22,4	25,3
219,1*)	4,5	0,176	23,7						17,2	19,3	21,4	23,7	26,4	29,4	33,2
273*)	5	0,192	33,0						21,5	24,1	26,7	29,7	33,0	36,8	41,6
323,9*)	5,6	0,219	43,8							28,6	31,8	35,3	39,3	43,8	49,5
355,6*)	5,6	0,219	48,2								34,9	38,8	43,2	48,2	54,5
406,4*)	6,3	0,250	62,4									44,4	49,5	55,1	62,4
419	6,3	0,250	64,3									45,8	51,0	56,9	64,3
457,2	6,3	0,250	70,3										55,8	62,1	70,3
508*)	6,3	0,250	78,2										62,0	69,1	78,2
559	6,3	0,250	86,1										68,3	76,1	86,1
610*)	6,3	0,250	94,1											83,1	94,1
660	7,1	0,281	115												102
711*)	7,1	0,281	124												110
762	8	0,312	148												118
813*)	8	0,312	158												126
864	8,8	0,344	185												134
914*)	10	0,394	223												142
1016*)	10	0,394	248												157
1120	11	0,438	302												174
1220	12,5	0,500	375												
1320	12,5	0,500	406												
1420	14,2	0,562	493												
1520	14,2	0,562	528												
1620	16	0,625	630												
1720	17,5	0,688	734												
1820	17,5	0,688	777												
1920	20	0,787	937												
2020	20	0,787	986												

Sizes not enclosed within the bold lines are not covered by DIN 2458.
* Up to 139.7 mm incl., these outside diameters are in conformity with threaded pipe to ISO Recommendation R 7; from 168.3 mm in conformity with threaded pipe to ANSI B 2.1, API Stds 5A, 5L and 5LX (without threads).

Welded Steel Tubing and Pipe - sizes and weights

DIN 2458 **(Extract from ISO Recommen**

Other Wall Thicknesses mm/in.												Outside Diameter		Suited for pipe threads2) to DIN 259 and DIN 2999
7,1	8	8,8	10	11	12,5	14,2	16	17,5	20	22,2	25			
0,281	0,312	0,344	0,394	0,438	0,500	0,562	0,625	0,688	0,787	0,875	1			
Weight kg/m												mm	in.	
												10,2*)	0,402	R 1/8”
												13,5*)	0,531	R 1/4”
												16	0,630	
												17,2*)	0,677	R 3/8”
												21,3*)	0,840	R 1/2”
												25	-	
												26,9*)	1,059	R 3/4”
												30	1,181	
												31,8	1,250	
												33,7*)	1,327	R 1”
												38	1,500	
												42,4*)	1,669	R 1 1/4”
												44,5	1,750	
												48,3*)	1,900	R 1 1/2”
												51	2	
												57	2,250	
												60,3*)	2,375	R 2”
												70	2,750	
												76,1*)	3	R 2 1/2”
												88,9*)	3,500	R 3”
												101,6*)	4	
18,8												108	4,250	
21,0												114,3*)	4,500	R 4”
												127	5	
22,1												133	5,250	
23,3												139,7*)	5,500	R 5”
25,5												152,4	6	
26,6	29,6											159	6,250	
27,7	30,9											165,1	6,500	R 6”
28,3	31,5											168,3*)	6,625	
37,2	41,5	45,4	51,6	56,7	64,1							219,1*)	8,625	
46,7	52,1	57,1	64,9	71,4	80,9							273,0*)	10,750	
55,6	62,1	68,1	77,4	85,3	96,7							323,9*)	12,750	
61,2	68,3	74,9	85,2	93,9	107							355,6*)	14	
70,1	78,3	85,9	97,8	108	122							406,4*)	16	
72,3	80,7	88,7	101	111	126							419	16,500	
79,0	88,2	96,9	110	122	138							457,2	18	
87,9	98,2	108	123	135	154							508,0*)	20	
96,9	108	119	135	149	170	191	213	233	266			559	22	
106	118	130	148	163	185	209	233	255	291			610,0*)	24	
115	128	141	160	177	201	227	253	277	315	349	395	660,0	26	
124	138	152	173	191	217	245	273	299	341	377	426	711,0*)	28	
133	148	163	185	205	233	263	293	321	366	405	458	762,0	30	
141	158	174	198	219	249	280	313	343	391	433	489	813,0*)	32	
150	168	185	211	232	264	298	333	365	416	461	521	864	34	
159	178	196	223	246	280	316	353	386	441	489	552	914,0*)	36	
177	198	218	248	274	312	352	393	430	491	544	615	1016,0*)	40	
195	218	240	274	302	344	388	434	475	542	601	680	1120	44,1	
213	238	262	298	330	375	423	473	518	591	656	742	1220	48	
230	258	284	323	357	406	458	512	562	641	711	805	1320	52	
	277	305	348	384	437	493	552	605	690	765	866	1420	55,9	
	297	327	372	411	468	528	591	647	739	820	928	1520	59,8	
	316	348	397	439	499	564	630	691	789	875	991	1620	63,8	
		370	422	466	530	599	669	734	838	929	1053	1720	67,7	
		392	446	493	562	634	709	777	887	985	1115	1820	71,7	
			471	521	592	669	748	820	937	1039	1177	1920	75,6	
			496	548	623	704	787	863	986	1094	1239	2020	79,5	

[1] Usually, standard sizes are available from stock. In general, welded tubing and pipe are only manufactured in those sizes for which weights are indicated. Other sizes upon request. English units are conversions of the metric ones.
[2] Minimum wall thickness see DIN 2440.

mm sizes

O.D.	Thickness	I.D.	Minimum guaranteed thickness	kg/m.	Centering on O.D. maximum O.D.	Centering on O.D. minimum I.D.	Centering on I.D. maximum O.D.	Centering on I.D. minimum I.D.	
32,00	6,00	20,00	5,7	4,2	31,5	21,6	30,4	20,5	Series 1
36,00	5,5	25,00	5,2	4,5	35,5	26,6	34,4	25,5	
40,00	6,00	28,00	5,7	5,4	39,5	29,6	38,4	28,5	
45,00	6,5	32,00	6,2	6,6	44,5	33,6	43,4	32,5	
50,00	7,00	36,00	6,7	7,9	49,5	37,6	48,4	36,5	
56,00	8,00	40,00	7,6	10,0	55,5	41,9	54,2	40,5	
63,00	6,5	50,00	6,2	9,9	62,00	51,9	61,4	51,00	
71,00	7,5	56,00	7,1	12,7	70,00	58,2	69,1	57,00	
75,00	7,5	60,00	7,1	13,6	74,00	62,3	73,1	61,00	
80,00	8,5	63,00	8,1	16,3	79,00	65,5	77,9	64,00	
85,00	9,00	67,00	8,6	18,3	84,00	69,6	82,8	68,00	
90,00	9,5	71,00	9,0	20,5	89,00	73,8	87,6	72,00	
95,00	10,00	80,00	9,5	22,9	94,00	77,9	92,5	76,00	
100,00	10,00	80,00	9,5	24,2	99,00	83,0	97,4	81,00	
106,00	13,00	90,00	12,4	32,0	105,00	83,4	103,1	81,00	
112,00	11,00	90,00	10,5	30,0	111,00	93,3	109,1	91,00	
118,00	14,00	90,00	13,3	38,8	117,00	93,8	114,8	91,00	
125,00	12,5	100,00	11,9	37,8	124,00	103,8	121,8	101,00	
132,00	13,00	106,00	12,4	41,8	131,00	109,9	128,6	107,00	
140,00	14,00	112,00	13,3	47,5	139,00	116,2	136,4	113,00	
150,00	12,5	125,00	11,9	47,0	149,00	129,3	146,3	126,00	
160,00	14,00	132,00	13,3	55,8	159,00	136,6	156,0	133,00	
170,00	15,00	140,00	14,3	63,4	169,00	144,9	165,7	141,00	
180,00	15,00	150,00	14,3	68,0	179,00	155,1	175,5	151,00	
190,00	15,00	160,00	14,3	72,3	189,00	165,3	185,3	161,00	
200,00	20,00	160,00	19,0	96,8	199,00	166,0	194,8	161,00	
212,00	21,00	170,00	20,0	108,0	211,00	176,3	206,5	171,00	
224,00	22,00	180,00	20,9	120,0	223,00	186,7	218,2	181,00	
236,00	23,00	190,00	21,9	132,2	235,00	197,0	229,9	191,00	
250,00	25,00	200,00	23,8	151,8	249,00	207,5	243,5	201,00	



O.D.	Thickness	I.D.	Minimum thik-kness	kg/m.	Centering on O.D. maximum O.D.	Centering on O.D. minimum I.D.	Centering on I.D. maximum O.D.	Centering on I.D. minimum I.D.	Series
36,00	8,00	20,00	7,6	5,8	35,5	21,8	34,2	20,5	Series 2
40,00	7,5	25,00	7,1	6,4	39,5	26,8	38,2	25,5	
45,00	8,5	28,00	8,1	8,1	44,5	29,8	43,2	28,5	
50,00	9,00	32,00	8,5	9,6	49,5	34,0	48,0	32,5	
56,00	10,00	36,00	9,4	11,9	55,5	38,3	53,8	36,5	
63,00	11,5	40,00	10,9	15,2	62,00	42,4	61,1	41,00	
71,00	13,00	45,00	12,4	19,5	70,00	47,7	68,8	46,00	
75,00	12,5	50,00	11,9	20,3	74,00	52,8	72,8	51,00	
80,00	15,00	50,00	14,3	25,2	79,00	53,1	77,5	51,00	
85,00	15,00	55,00	14,3	27,2	84,00	58,2	82,4	56,00	
90,00	13,5	63,00	12,8	27,0	89,00	66,2	87,4	64,00	
95,00	14,00	67,00	13,3	29,7	94,00	70,3	92,3	68,00	
100,00	14,5	71,00	13,8	32,4	99,00	74,5	97,1	72,00	
106,00	17,5	71,00	16,6	40,0	105,00	74,9	102,8	72,00	
112,00	16,00	80,00	15,2	40,1	111,00	83,8	108,8	81,00	
118,00	19,00	80,00	18,1	48,9	117,00	84,3	114,5	81,00	
125,00	17,5	90,00	16,6	49,4	124,00	94,3	121,5	91,00	
132,00	21,00	90,00	20,0	60,7	131,00	94,7	128,1	91,00	
140,00	20,00	100,00	19,0	63,0	139,00	104,8	136,0	101,00	
150,00	22,00	106,00	20,9	73,7	149,00	111,2	145,7	107,00	
160,00	24,00	112,00	22,8	85,0	159,00	117,6	155,4	113,00	
170,00	26,00	118,00	24,7	97,8	169,00	124,0	165,0	119,00	
180,00	27,5	125,00	26,1	109,5	179,00	131,4	174,8	126,00	
190,00	29,00	132,00	27,6	121,5	189,00	138,7	184,5	133,00	
200,00	30,00	140,00	28,5	133,1	199,00	147,0	194,2	141,00	
212,00	31,00	150,00	29,5	147,0	211,00	157,3	205,9	151,00	
224,00	32,00	160,00	30,4	161,0	223,00	167,7	217,6	161,00	
236,00	33,00	170,00	31,4	176,0	235,00	178,0	229,3	171,00	
250,00	35,00	180,00	33,3	197,4	249,00	188,5	242,9	181,00	
32,00	8,00	16,00	7,6	5,0	31,5	17,8	30,2	16,5	Series 3
36,00	10,00	16,00	9,5	6,7	35,5	18,0	34,0	16,5	
40,00	10,00	20,00	9,5	7,7	39,5	22,0	38,0	20,5	
45,00	12,5	20,00	11,9	10,4	44,5	22,2	42,8	20,5	
50,00	12,5	25,00	11,9	12,0	49,5	27,2	47,8	25,5	
56,00	14,00	28,00	13,3	15,0	55,5	30,5	53,6	28,5	
63,00	15,5	32,00	14,7	18,7	62,00	34,8	60,8	33,00	
71,00	17,5	36,00	16,6	23,7	70,00	39,2	68,5	37,00	
75,00	17,5	40,00	16,6	25,8	74,00	43,3	72,5	41,00	
80,00	20,00	40,00	19,0	30,6	79,00	43,6	77,2	41,00	
85,00	20,00	45,00	19,0	33,3	84,00	48,7	82,1	46,00	
90,00	20,00	50,00	19,0	35,8	89,00	53,8	87,0	51,00	
95,00	22,5	50,00	21,4	41,6	94,00	54,2	91,8	51,00	
100,00	22,00	56,00	20,9	43,9	99,00	60,2	96,7	57,00	
106,00	25,00	56,00	22,8	51,8	105,00	60,6	102,4	57,00	
112,00	24,5	63,00	23,3	54,9	111,00	67,7	108,3	64,00	
118,00	27,5	63,00	26,1	63,7	117,00	68,1	114,0	64,00	
125,00	27,00	71,00	25,7	67,8	124,00	76,2	120,9	72,00	
132,00	30,5	71,00	29,0	79,1	131,00	76,7	127,5	72,00	
140,00	30,00	80,00	28,5	84,7	139,00	85,8	135,4	81,00	
150,00	35,00	80,00	33,3	102,9	149,00	86,5	144,9	81,00	
160,00	35,00	90,00	33,3	112,0	159,00	96,7	154,7	91,00	
170,00	35,00	100,00	33,3	121,0	169,00	106,9	164,5	101,00	
180,00	40,00	100,00	38,0	143,4	179,00	107,6	174,0	101,00	
190,00	42,00	106,00	39,9	159,0	189,00	114,0	183,7	107,00	
200,00	44,00	112,00	41,8	176,0	199,00	120,4	193,4	113,00	
212,00	43,5	125,00	41,3	188,4	211,00	133,6	205,2	126,00	
224,00	46,00	132,00	43,7	210,5	223,00	141,1	216,8	133,00	
236,00	48,00	140,00	45,6	232,0	235,00	149,5	228,4	141,00	
250,00	50,00	150,00	47,5	257,0	249,00	160,0	242,0	151,00	

Weight kg/m

OD/WT	1.0	1.2	1.4	1.6	1.8	2.0	2.3	2.4	2.5	2.6	2.8	2.9	3.2	3.5	4.0	4.2	4.5	4.8	5.0	5.5	5.8	6.0
15																						
17.8																						
19		0.527	0.608	0,687	0.763	0.838	0.947	0.982	1.02	1.05	1.12											
21.7		0.607	0.701	0.973	0.883	0.972	1.10	1.14	1.18	1.22	1.31	1.34	1.46									
25.4		0.716	0.829	0.939	1.05	1.15	1.31	1.36	1.41	1.46	1.56	1.61	1.75	1.89	2.11							
26.7		0.765	0.886	0.979	1.09	1.21	1.39	1.44	1.50	1.54	1.65	1.71	1.85	2.00	2.24							
27.2		0.769	0.891	1.01	1.13	1.24	1.41	1.47	1.52	1.58	1.68	1.74	1.89	2.05	2.29							
28.6		0.811	0.939	1.07	1,19	1.31	1.49	1.55	1.61	1.67	1.78	1.84	2.00	2.17	2.43							
31.8		0.906	1.05	1.19	1.33	1.47	1.67	1.74	1.81	1.87	2.00	2.07	2.26	2.44	2.74	2.86	3.03					
34.0		0.971	1.13	1.28	1.43	1.58	1.80	1.87	1.94	2.01	2.15	2.22	2.43	2.63	2.96	3.09	3.27					
36.4		1.05	1.22	1.35	1.52	1.68	1.94	2,01	2,10	2,16	2,32	2,41	2,62	2,82	3,20	3,34	3,54					
38.1		1,09	1,27	1,44	1,61	1,78	2,03	2,11	,19	2,28	2,44	2,52	2,75	2,99	3,36	3,51	3,73	3,94	4,08	4,42	4,62	4,75
42.3		1,23	1,43	1,58	1,78	1,97	2,28	2,36	2,46	2,54	2,73	2,83	3,08	3,33	3,79	3,95	4,19	4,42	4,58	4,99	5,22	5,37
42.7		1,23	1,43	1,62	1,82	2,01	2,29	2,39	2,48	2,57	2,76	2,85	3,12	3,38	3,82	3,99	4,24	4,47	4,65	5,05	5,28	5,43
44.0		1,28	1,49	1,65	1,85	2,05	2,37	2,46	2,57	2,65	2,84	2,95	3,22	3,48	3,96	4,12	4,38	4,62	4,79	5,22	5,46	5,62
45.0		1,30	1,51	1,71	1,92	2,12	2,42	2,52	2,62	2,72	2,91	3,01	,30	3,58	4,04	4,23	4,49	4,74	4,93	5,36	5,61	5,77
48.6		1,40	1,63	1,85	2,08	2,30	2,63	2,73	2,84	2,95	3,16	3,27	3,58	3,89	4,40	4,60	4,89	5,18	5,38	5,85	6,12	6,30
50.8		1,48	1,71	1,94	2,18	2,41	2,75	2,86	2,98	3,09	3,31	3,43	3,76	4,08	4,62	4,83	5,14	5,44	5,65	6,14	6,44	6,63
51.0		1,49	1,73	1,92	2,16	2,41	2,76	2,88	3,00	3,10	3,33	3,44	3,77	4,10	4,64	4,85	5,16	5,45	5,67	6,17	6,46	6,66
54.0		1,58	1,84	2,04	2,29/	2,56	2,93	3,05	3,19	3,30	3,54	3,65	4,01	4,36	4,93	5,16	5,49	5,80	6,04	6,58	6,89	7,10
57.0			1,94	2,19	2,45	2,71	3,10	3,23	3,36	3,49	3,74	3,87	4,25	4,62	5,23	5,47	5,83	6,18	6,41	6,98	7,32	7,55
60.3			2,06	2,31	2,57	2,85	3,29	3,43	3,58	3,70	3,97	4,10	4,51	4,90	5,55	5,81	6,19	6,57	6,82	7,43	7,80	8,03
60.5			2,06	2,32	2,61	2,89	3,30	3,44	3,58	3,71	3,98	4,12	4,52	4,92	5,57	5,83	6,21	6,59	6,84	7,46	7,82	8,06
63.5			2,17	2,41	2,74	3,03	3,47	3,62	3,76	3,90	4,19	4,33	4,76	5,18	5,87	6,14	6,55	6,95	7,21	7,87	8,25	8,51
65.0			2,22	2,47	2,81	3,11	3,56	3,70	3,85	4,00	4,29	4,44	4,88	5,31	6,02	6,30	6,71	7,13	7,40	8,07	8,47	8,73
70.0				2,70	3,03	3,35	3,84	4,00	4,16	4,32	4,64	4,80	5,27	5,74	6,51	6,82	7,27	7,72	8,01	8,75	9,18	9,47
73.0				2,82	3,16	3,47	4,03	4,18	4,37	4,51	4,85	5,01	5,51	6,00	6,81	7,13	7,60	8,04	8,38	9,16	9,61	9,91
75.0				2,90	3,25	3,57	4,14	4,30	4,49	4,64	4,99	5,16	5,67	6,17	7,00	7,33	7,82	8,28	8,63	9,43	9,90	10,2
76.2				2,94	3,30	3,63	4,19	4,37	4,56	4,72	5,07	5,24	5,76	6,27	7,12	7,46	7,96	8,42	8,78	9,59	10,1	10,4
76.3				2,95	3,31	3,66	4,20	4,37	4,55	4,73	5,08	5,25	5,77	6,28	7,13	7,47	7,97	8,46	8,79	9,60	10,1	10,4
82.6				3,20	3,59	3,94	4,57	4,75	4,96	5,13	5,51	5,70	6,27	6,83	7,75	8,12	8,67	9,18	9,57	10,5	11,0	11,3
88.9				3,44	3,87	4,25	4,93	5,12	5,35	5,52	5,95	6,15	6,76	7,37	8,37	8,77	9,37	9,92	10,3	11,3	11,9	12,3
89.1				3,45	3,88	4,30	4,92	5,13	5,34	5,55	5,96	6,16	6,78	7,39	8,39	8,79	9,39	9,98	10,4	11,3	11,9	12,3
101.6						4,91	5,63	5,87	6,11	6,35	6,82	7,06	7,76	8,47	9,63	10,1	10,8	11,5	11,9	13,0	13,7	14,1
114.3						5,54	6,37	6,62	6,89	7,16	7,70	7,97	8,77	9,56	10,9	11,4	12,2	13,0	13,5	14,8	15,5	16,0
127.0						6,16	7,07	7,37	7,68	7,98	8,58	8,86	9,78	10,7	12,1	12,7	13,6	14,4	15,0	16,5	17,3	17,9
139.8						6,80	7,80	8,13	8,46	8,80	9,46	9,79	10,8	11,8	13,4	14,0	15,0	16,0	16,6	18,2	19,2	19,8
141.3						6,87	7,88	8,22	8,53	8,89	9,47	9,80	10,8	11,8	13,4	14,1	15,0	16,0	16,6	18,2	19,2	19,8
152.4						7,42	8,51	8,88	9,24	93,60	10,3	10,7	11,7	12,8	14,6	15,3	16,4	17,4	18,2	19,9	21,0	21,7
165.2						8,05	9,24	9,64	10,0	10,4	11,2	11,6	12,8	14,0	15,9	16,7	17,8	19,0	19,8	21,7	22,8	23,6
168.3						8,20	9,42	9,82	10,2	10,6	11,4	11,8	13,0	14,2	16,2	17,0	18,2	19,4	20,1	22,1	23,2	24,0
177.8						8,67	9,95	10,4	10,8	11,2	12,1	12,5	13,8	15,0	17,1	18,0	19,2	20,5	21,3	23,4	24,6	25,4
190.7											13,0	13,4	14,8	16,2	18,4	19,3	20,7	22,0	22,9	25,1	26,4	27,3
216.3											14,7	15,3	16,8	18,4	20,9	22,0	23,5	25,0	25,9	28,6	30,1	31,1
219.1											14,9	15,5	17,0	18,7	21,2	22,3	23,8	25,4	26,3	29,0	30,5	31,5
244.5														20,8	23,7	24,9	26,6	28,2	29,4	32,4	34,1	35,3
267.4														22,8	26,0	27,3	29,2	31,1	32,2	32,5	37,4	38,7
273.1														23,2	26,5	27,8	29,8	31,6	32,9	36,3	48,2	39,5
318.5															31,0	32,63	34,8	37,1	38,5	42,5	44,7	46,2
323.9															31,6	33,1	35,4	37,8	39,2	43,3	45,5	47,0
339.7															33,1	34,7	37,2	39,6	41,3	45,3	57,8	49,4
355.6																	39,0	41,5	43,1	47,6	50,0	51,7
406.4																	44,6	47,0	49,5	54,5	57,3	59,2
457.2																	50,2	53,5	55,8	61,4	64,6	66,7
508.0																	55,9	59,6	62,0	68,2	71,8	74,3
558.8																				75,0	79,1	81,8
609.6																				81,9	86,4	89,3

6.2	6.4	6.5	6.6	6.9	7.0	7.5	7.9	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.7	14.3	15.1	16.0	17.5	19.1
4,88	5,00	5307	5,13	5,31	5,37																	
5,52	5,67	5,74	5,81	6,02	6,09																	
5,58	5,73	5,80	5,88	6,09	6,16																	
5,78	5,93	6,01	6,09	6,31	6,39	6,75																
5,93	6,09	6,41	6,25	6,48	6,56	6,94																
6,48	6,66	6,74	6,84	7,10	7,18	7,60																
6,82	7,01	7,10	7,19	7,47	7,56	8,01	8,36	8,44														
6,85	7,04	7,13	7,23	7,50	7,60	8,05	8,40	8,48														
7,31	7,51	7,61	7,71	8,01	8,11	8,60	8,98	9,07	9,5													
7,77	7,99	8,09	8,20	8,52	8,63	9,16	9,32	9,67	10,2													
8,27	8,51	8,62	8,74	9,09	9,20	9,77	10,2	10,3	10,9	11,4												
8,30	8,54	8,66	8,17	9,12	9,24	9,80	10,3	10,4	10,9	11,4												
8,76	9,01	9,14	9,2	9,63	9,75	10,4	10,8	10,9	11,5	12,1												
8,99	9,25	9,38	9,51	9,89	10,0	10,6	11,2	11,2	11,8	12,4												
9,75	10,0	10,2	10,3	10,7	10,9	11,6	12,1	12,2	12,9	13,5	14,2											
10,2	10,5	10,7	10,8	11,2	11,4	12,1	12,7	12,8	13,5	14,2	14,9											
10,5	10,8	11,0	11,1	11,6	11,7	12,8	13,1	13,2	13,9	14,6	15,3	16,0										
10,7	11,0	11,2	11,3	11,8	11,9	12,7	13,3	13,5	14,2	14,9	15,6	16,3										
10,7	11,0	11,2	11,3	11,8	12,0	12,7	13,3	13,5	14,2	14,9	15,6	16,3										
11,7	12,0	12,2	12,4	12,9	13,1	13,8	14,6	14,7	15,5	16,3	17,1	17,9										
12,6	13,0	13,2	13,4	14,0	14,1	15,0	15,8	16,0	16,9	17,7	18,6	19,5	20,3	21,1	21,9							
12,7	13,1	13,2	13,4	14,0	14,2	15,0	15,8	16,0	16,9	17,8	18,6	19,5	20,4	21,2	22,0							
14,6	15,0	15,2	15,5	16,1	16,3	17,4	18,3	18,5	19,6	20,6	21,6	22,6	23,6	24,6	25,6							
16,5	17,0	17,3	17,5	18,3	18,5	19,7	20,7	21,0	22,2	23,4	24,6	25,7	26,9	28,0	29,2	30,3	31,8					
18,5	19,0	19,3	19,6	20,4	20,7	22,1	23,2	23,5	24,8	26,2	27,5	28,9	30,2	31,5	32,8	34,0	35,8					
20,4	21,1	21,1	21,7	22,6	22,9	24,4	25,7	26,0	27,5	29,0	30,5	32,0	33,5	34,9	36,4	37,8	39,8					
21,3	21,1	21,4	21,7	22,6	23,0	24,5	25,7	26,6	27,8	29,1	30,6	32,4	33,9	35,3	36,8	38,3	40,3					
22,4	23,3	23,4	23,7	24,8	25,1	26,8	28,2	28,5	30,2	31,8	33,5	35,1	35,4	38,4	40,0	41,5	43,8					
24,3	25,1	25,4	25,8	26,9	27,3	29,1	30,6	31,0	32,8	34,7	36,5	38,3	40,1	41,8	43,6	45,3	47,8					
24,8	25,6	25,9	26,3	27,5	27,8	29,7	31,2	31,6	33,5	35,4	37,2	39,0	40,9	42,7	44,5	46,3	48,7					
26,2	27,1	27,5	27,9	29,1	29,5	31,5	33,1	33,5	35,5	37,5	39,4	41,4	43,3	45,2	47,2	49,1	51,7					
28,2	29,1	29,5	30,0	31,3	31,7	33,9	35,6	36,0	38,1	40,3	42,4	44,6	46,7	48,7	50,8	52,9	55,7	62,2				
32,1	33,1	33,6	34,1	35,6	36,1	38,6	40,6	41,1	43,6	46,0	48,4	50,9	53,3	55,7	58,1	60,5	63,7	71,2	74,9			
32,6	33,6	34,1	34,6	36,1	366,6	39,1	41,1	41,6	44,1	46,6	49,1	51,6	54,0	56,4	58,9	61,3	64,6	72,2	76,0			
36,4	37,6	38,1	38,7	40,4	41,0	43,8	46,1	46,7	49,5	52,3	55,1	57,8	60,6	63,3	66,1	68,8	70,9	81,2	85,4			
39,9	41,2	41,8	42,4	44,3	45,0	48,0	50,6	51,2	54,3	57,3	604	63,5	66,5	69,6	72,6	75,6	79,8	89,3	93,9	99,2		
40,8	42,1	42,7	43,4	45,3	45,9	49,1	51,7	52,3	55,5	58,6	61,7	64,9	68,0	71,1	74,2	77,3	81,5	91,3	91,3	101		
47,7	49,3	50,0	50,8	53,0	53,8	57,5	60,5	61,3	65,0	68,7	72,4	76,1	79,8	83,4	87,1	90,7	95,8	107	113	119	130	
48,6	50,1	50,9	51,6	53,9	54,7	58,5	61,6	62,3	66,1	69,9	73,7	77,4	81,1	84,9	88,6	92,3	97,5	109	115	121	132	
51,0	52,6	53,4	54,2	56,6	57,4	61,4	64,4	65,4	69,4	73,4	77,4	81,3	85,2	89,2	93,1	97,0	102	115	121	128	139	
53,4	55,1	55,8	56,8	59,3	60,2	64,3	67,7	68,6	72,8	76,9	81,1	85,2	89,4	93,5	97,6	102	107	120	127	134	146	158
61,2	63,1	63,9	65,1	68,0	69,0	73,7	77,6	78,4	83,4	88,2	93,0	97,8	103	107	112	117	123	138	146	154	168	182
69,0	71,1	72,1	73,3	76,6	77,8	83,1	87,5	88,4	94,1	99,5	105	110	116	121	126	132	139	156	165	174	190	206
76,7	79,2	80,4	81,6	85,3	86,5	92,6	97,4	98,6	105	111	117	123	129	135	141	147	155	174	184	194	212	230
84,5	87,2	88,5	89,9	93,9	95,3	102	107	109	115	122	129	135	142	149	155	162	171	192	202	214	234	
92,3	95,2	96,7	98,1	103	104	111	117	119	126	133	141	148	155	162	170	177	187	210	221	234		

Nominal O.D.		Diameter (mm)		Wall Thickness																	
A	B	O.D.	I.D.	6.0	6.4	7.0	7.9	8.0	9.0	9.5	10.0	11.0	12.0	12.7	13.0	14.0	15.0	16.0	17	18	19
	16	400.0		58.3	62.2	67.8	76.4	77.3	86.8	91.5	96.2	106	115	121							
400		406.4		59.2	63.1	66.9	77.6	78.6	88.2	93.5	97.8	107	117	123	126	135	145	154	163	172	182
450	18	457.2		66.8	71.1	77.7	87.5	88.6	99.5	105	110	121	132	139	142	153	164	174	185	195	205
		500		73.1	77.9	85.1	95.9	97.1	109	115	121	133	144	153	156	168	179	191	202	211	225
500	20	508.0		74.3	79.2	86.5	97.4	98.6	111	117	123	135	147	155	159	171	182	194	206	218	229
			500	74.9	79.9	87.5	98.9	100	113	119	126	139	152	161	164	177	190	204	217	230	243
550	22	558.8		81.8	87.2	95.3	107	109	122	129	135	149	162	171	175	188	201	214	227	240	253
		600		87.9	93.7	102	115	117	131	138	145	160	174	184	188	202	216	230	244	258	272
600	24	609.6		89.3	95.2	104	117	119	133	141	148	162	177	187	191	206	220	234	248	263	277
			600	89.7	95.7	105	118	120	135	143	150	166	181	192	197	212	227	243	258	274	290
650	26	660.4		96.8	103	113	127	129	145	152	160	176	192	203	207	223	239	254	270	285	301
		700		103	109	120	135	137	153	161	170	17	204	215	220	237	253	270	286	303	319
700	28	711.2		104	111	12	137	139	156	164	173	196	207	219	224	241	258	274	291	308	324
			700	104	111	122	138	140	157	166	175	193	211	223	229	247	264	283	301	319	337
750	30	762.0		112	119	130	147	149	167	176	185	204	222	235	240	258	276	294	312	330	348
		800		117	125	137	155	156	176	185	195	214	233	247	22	271	290	309	328	347	366
800	32	812.8		119	127	139	157	159	178	188	198	217	237	251	256	276	295	314	334	353	372
			800	119	127	139	157	159	180	190	200	220	240	255	261	281	301	322	343	363	384
850	34	863.6		127	135	148	167	169	190	200	210	231	252	266	273	293	314	334	355	375	396
900	36	914.4		134	143	154	177	179	201	212	223	245	267	282	289	311	333	354	376	398	420
			900	134	143	157	177	179	202	213	224	247	270	286	293	316	338	361	384	407	431
	38	965.2		142	151	165	181	189	212	224	236	259	282	298	305	328	351	375	398	420	443
1000	40	1016.0		149	159	174	196	199	223	236	248	273	297	314	322	346	370	395	419	443	467
			1000	149	159	174	196	199	224	236	249	274	299	317	325	350	375	401	426	452	477
	42	1066.8		157	167	183	206	209	235	248	261	286	312	330	338	363	389	415	440	466	491
1000	44	1117.6		164	175	192	216	219	246	260	273	300	327	346	354	381	408	435	461	488	515
			1100	164	175	191	216	219	246	260	274	301	329	348	357	385	4512	440	468	496	524
	46	1168.4		177	183	200	226	229	257	271	286	314	342	362	370	399	427	455	483	511	539
1200	48	1219.2				209	236	239	269	283	298	328	357	378	387	416	445	475	504	533	562
			1200			208	235	238	268	283	298	328	359	380	389	469	449	480	510	541	571
1350	50	1371.6				236	266	269	302	319	336	369	402	426	436	469	502	535	568	601	634
			1350			234	265	268	302	318	335	369	403	427	437	471	505	539	573	607	641
1500	60	1524.0						299	336	355	373	410	447	473	454	521	558	595	632	668	702
			1500					297	335	354	372	410	447	474	485	523	560	598	636	674	712
1600	64	1625.6							359	379	398	438	477	505	517	556	596	635	674	714	753
			1600						357	377	397	437	477	505	517	557	597	638	678	718	759
1800	72	1828.8							404	426	449	493	538	569	582	627	671	715	760	804	848
			1800						401	424	446	491	536	568	581	626	671	717	762	807	852
			2000									546	595	630	645	696	745	795	846	896	946
			2100									573	625	662	677	730	782	835	887	940	993
			2200										655	693	709	764	819	874	929	985	1040
			2300										684	724	742	799	856	914	971	1029	1087
			2400											756	774	833	893	953	1013	103	1133
			2500											787	806	868	930	993	1055	1118	1180
			2600											818	838	902	967	1032	1097	1162	1227
			2700													937	1004	1072	1139	1206	1274
			2800													972	1041	1111	1181	1251	1321
			2900													1006	1078	1151	1223	1295	1368
			3000													1041	1115	1190	1265	1340	1415

	20	21	22	23	24	25	26	27	28	29	30	32	34	36	38	40	42	44	46	48	50
	216	226	236	246	256	266	276	286	296	306	316	336	355								
	237	248	259	271	282	293	304	315	326	337	348	369	391								
	241	252	264	275	286	298	309	320	331	343	354	376	397	419	440						
	256	268	283	297	310	324	337	352	365	378	392	420	448	476	504						
	266	278	291	304	317	329	342	354	366	379	391	416	440	464	488	512					
	286	300	314	327	341	354	368	382	395	408	422	448	475	501	527	552					
	291	305	319	333	347	360	374	388	402	415	429	456	483	509	536	562	588	614			
	305	321	337	353	369	385	401	417	434	450	466	499	532	565	598	631	665	669			
	316	331	346	362	377	392	407	422	437	452	466	496	525	554	583	612	640	669	697		
	335	352	368	384	400	416	432	448	464	480	489	527	560	589	620	651	682	712	742		
	341	357	374	390	407	43	439	456	472	488	504	536	568	599	631	662	693	724	755	785	815
	355	373	392	410	428	447	465	484	503	521	540	578	615	653	692	730	769	807	846	885	925
	366	384	401	419	437	454	472	489	507	524	542	576	610	645	678	712	746	779	812	845	878
	385	403	422	441	459	478	496	515	533	551	570	609	642	678	714	750	785	820	855	890	925
	391	410	429	448	467	486	504	523	542	561	579	616	653	690	726	762	798	834	870	905	991
	404	425	446	467	488	509	530	551	572	593	614	657	699	742	785	829	872	916	960	1004	1148
	416	436	457	477	497	517	537	557	577	597	617	656	696	735	774	812	851	889	927	965	1003
	441	463	484	506	527	548	570	591	612	633	654	696	738	780	821	862	904	944	985	1026	1066
	454	477	500	524	547	570	594	617	641	644	688	735	783	831	879	927	976	1024	1073	1122	1171
	466	489	512	534	557	580	602	625	641	670	691	736	781	825	869	913	956	1000	1147	1199	1128
	491	515	539	563	587	611	635	658	682	706	729	776	823	870	916	963	1009	1055	1100	1146	1191
	503	529	554	580	606	632	658	684	710	736	762	814	867	920	973	1026	1079	1133	1187	1241	1295
	516	542	567	593	617	642	667	692	717	742	767	817	866	915	964	1013	1061	1110	1158	1206	1254
	541	568	594	621	647	674	700	726	752	779	805	857	909	960	1012	1063	1114	1165	1216	1266	1316
	552	580	609	637	665	694	722	750	779	807	836	893	951	1008	1066	1124	1183	1241	1300	1359	1418
	566	594	622	650	677	705	732	760	787	815	842	897	951	1005	1059	1113	1167	1220	1273	1326	1379
	591	620	650	678	707	736	765	794	822	851	880	937	994	1050	1107	1163	1219	1275	1331	1386	1442
	602	3632	663	694	724	755	786	817	848	879	910	972	1035	1097	1161	1223	1286	1350	1413	1477	1541
	667	699	732	765	798	830	862	895	928	960	993	1057	1121	1186	1250	1313	1377	1440	1504	1567	1630
	676	710	744	779	813	848	882	917	951	986	1021	1091	1160	1230	1301	1371	1442	1513	1584	1655	1726
	741	778	815	851	888	924	960	997	1033	1069	1105	1178	1249	1321	1393	1464	1535	1606	1677	1747	1817
	750	788	826	864	902	940	678	1017	1055	1093	1132	1209	1286	1364	1441	1519					
	792	831	870	909	948	987	1026	1064	1103	1142	1180	1258	1334	1411	1488	1564					
	799	839	880	921	961	1002	1043	1083	1124	1165	1206	1288	1370	1452	1535	1618					
	892	936	980	1024	1068	1112	1156	1200	1253	1287	1331	1418	1505	1592	1678	1764					
	898	943	988	1034	1080	1125	1171	1216	1262	1308	1354	1446	1538	1630	1722	1815					
	996	1047	1097	1147	1198	1248	1299	1350	1400	1451	1502	1603	1705	1807	1910	2012	2115				
	1046	1098	1151	1204	1257	1310	1363	1416	1469	1523	1576	1682	1789	1896	2003	2111	2219				
	1095	1150	1205	1261	1316	1372	1427	1483	1538	1594	1650	1761	1873	1985	2097	2210	2322				
	1144	1202	1260	1318	1375	1433	1491	1549	1607	1666	1724	1840	1957	2074	2191	2308	2426				
	1194	1254	1314	1374	1435	1495	1555	1616	1676	1737	1798	1919	2041	2163	2285	2407	2529				
	1243	1306	1368	1431	1494	1557	1620	1683	1746	1809	1872	1998	2125	2251	2378	2505	2633				
	1292	1357	1422	1488	1553	1618	1684	1749	1815	1880	1946	2077	2208	2340	2472	2604	2736				
	1342	1409	1477	1544	1612	1680	1748	1816	1884	1952	2020	2156	2292	2429	2566	2703	2840	2977			
	1391	1460	1531	1601	1671	1742	1812	1882	1953	2023	2094	2235	2376	2518	2659	2801	2944	3086			
	1440	1513	1582	1658	1731	1803	1876	149	2022	2095	2168	2314	2460	2606	2753	200	3047	3194			
	1489	1564	1639	1715	1790	1865	1940	2015	2091	2166	2242	2393	2544	2695	847	2999	3151	3303			

Nominal O.D.		Outside Diameter		Wall Thickness														
				(mm) 2,0	2,5	3,0	3,5	4,0	4,5	5,0	5,5	6,0	6,5	7,0	7,5	8,0	8,5	9,0
A	B	mm	in	(in) 0,079	0,098	0,118	0,138	0,157	0,177	0,197	0,217	0,236	0,256	0,276	0,295	0,315	0,335	0,354
15	1/2	21,7	0,854															
20	3/4	27,2	1,07															
25	1	34,0	1,34															
32	1 1/4	42,7	1,68															
40	1 1/2	48,6	1,91															
50	2	60,5	2,38															
65	2 1/2	76,3	3,00															
80	3	89,1	3,19															
90	3 1/2	101,6	4,00															
100	4	114,3	4,50															

REMARKS: (shaded) Prior Consultation with the manufacturer is necessary







Standards: Seamless ASTM B 466
Welded ASTM B 467

Outside diameter of pipe ØD			Wall thickness		Theoretical weight	
nominal inch	**actual inch**	**actual mm**	**actual inch**	**actual mm**	**lb/ft**	**kg/**
SEAMLESS						
1/8	0.405	10.29	0.058	1.147	0.24	0.36
1/4	0.540	13.72	0.065	1.65	0.38	0.56
3/8	0.675	17.15			0.48	0.72
1/2	0.840	21.34			0.61	0.91
3/4	1.050	26.67			0.78	1.16
1	1.315	33.4			0.99	1.47
1 1/4	1.660	42.16	0.072	1.83	1.39	2.07
1 1/2	1.900	48.27			1.60	2.39
2	2.375	60.32	0.083	2.11	2.32	3.45
2 1/2	2.875	73.03			2.82	4.20
3	3.500	88.90	0.095	2.41	3.93	5.85
3 1/2	4.000	101.60			4.51	6.71
4	4.500	114.30	0.109	2.77	5.83	8.68
5	5.563	141.30	0.125	3.18	8.29	12.34
6	6.625	168.30	0.134	3.40	10.58	15.75
8	8.625	219.1			13.83	20.59
SEAMLESS OR SEAM WELD						
10	10.750	273.05	0.134	3.40	17.29	25.74
12	12.750	323.90	0.156	3.96	23.90	35.58
14	14.000	355.60	0.165	4.19	27.78	41.35
16	16.000	406.40			31.80	47.33
18	18.000	257.20	0.180	4.57	39.03	58.10
20	20.000	508.00			43.41	64.62
SEAM WELDED						
24	24.000	609.60	0.180	4.57	52.17	77.66
30	30.000	762.00	0.250	6.35	90.54	134.77

- Pipes in other wallthickness available upon request
- Fittings and Flanges available upon request
- Materials Alloy 706. Alloy 715. Alloy 687. Alloy 443

Dimension: ANSI/ASME B 36.19M

Outside diameter of pipe ØD			Schedule 5S				Schedule 10S			
			Wall thickness		Theoretical weight		Wall thickness		Theoretical weight	
Nominal	actual		acutal				actual			
inch	inch	mm	inch	mm	lb/ft	kg/m	inch	mm	lb/ft	kg/m
			SEAMLESS							
1/8	0.405	10.29					0.049	1.24	0.19	0.28
1/4	0.540	13.75					0.065	1.65	0.33	0.49
3/8	0.675	17.75					0.065	1.65	0.42	0.63
1/2	0.840	21.34	0.065	1.65	0.54	0.80	0.083	2.11	0.67	1.00
3/4	1.050	26.67	0.065	1.65	0.69	1.03	0.083	2.11	0.86	1.28
1	1.315	33.40	0.065	1.65	0.87	1.30	0.109	2.77	1.40	2.09
1 1/4	1.660	42.16	0.065	1.65	1.11	1.65	0.109	2.77	1.81	2.70
1 1/2	1.900	48.27	0.065	1.65	1.28	1.91	0.109	2.77	2.09	3.11
2	2.375	60.32	0.065	1.65	1.61	2.40	0.109	2.77	2.64	3.93
2 1/2	2.875	73.03	0.083	2.11	2.48	3.69	0.120	3.05	3.53	5.26
3	3.500	88.90	0.083	2.11	3.03	4.51	0.120	3.05	4.33	6.45
3 1/2	4.00	101.60	0.083	2.11	3.48	5.18	0.120	3.05	4.97	7.40
4	4.500	114.30	0.083	2.11	3.92	5.84	0.120	3.05	5.61	8.36
5	5.563	141.30	0.109	2.77	6.36	9.47	0.134	3.40	7.77	11.57
6	6.625	168.30	0.109	2.77	7.60	11.32	0.134	3.40	9.29	13.84
8	8.625	219.10	0.109	2.77	9.93	14.79	0.148	3.76	13.40	19.96
10	10.750	273.05	0.134	3.40	15.19	22.63	0.165	4.19	18.65	27.78
12	12.750	323.90	0.156	3.96	20.98	31.25	0.180	4.57	24.17	36.00

Outside diameter of pipe ØD			Schedule 40S				Schedule 80S			
			Wall thickness		Theoretical weight		Wall thickness		Theoretical weight	
Nominal	actual		acutal				actual			
inch	inch	mm	inch	mm	lb/ft	kg/m	inch	mm	lb/ft	kg/m
			SEAMLESS							
1/8	0.405	10.29	0.068	1.73	0.24	0.37	0.095	2.41	0.31	0.47
1/4	0.540	13.72	0.088	2.24	0.42	0.63	0.119	3.02	0.54	0.80
3/8	0.675	17.15	0.091	2.31	0.57	0.84	0.126	3.20	0.74	1.10
1/2	0.840	21.34	0.109	2.77	0.85	1.27	0.147	3.73	1.09	1.62
3/4	1.050	26.67	0.113	2.87	1.13	1.69	0.154	3.91	1.47	2.20
1	1.315	33.40	0.133	3.38	1.68	2.50	0.179	4.55	2.17	3.24
1 1/4	1.660	42.16	0.140	3.56	2.27	3.39	0.191	4.85	3.00	4.47
1 1/2	1.900	48.27	0.145	3.68	2.72	4.05	0.200	5.08	3.63	5.41
2	2.375	60.32	0.154	3.91	3.65	5.44	0.218	5.54	5.02	7.48
2 1/2	2.875	73.03	0.203	5.16	5.079	8.63	0.276	7.01	7.66	11.41
3	3.500	88.90	0.216	5.49	7.58	11.29	0.300	7.62	10.25	15.27
3 1/2	4.000	101.60	0.226	5.74	9.11	13.57	0.318	8.08	12.51	18.63
4	4.500	114.30	0.237	6.02	10.79	16.07	0.337	8.56	14.98	22.32
5	5.563	141.30	0.258	6.55	14.62	21.77	0.375	9.53	20.78	30.97
6	6.625	168.30	0.280	7.11	18.97	28.26	0.432	10.97	28.57	42.56
8	8.625	219.10	0.322	8.18	28.55	42.55	0.500	12.70	43.39	64.64
10	10.750	273.05	0.365	9.27	40.48	60.31	0.500	12.70	54.74	96.01
12	12.750	323.90	0.375	9.53	49.56	73.88	0.500	12.70	65.42	132.08

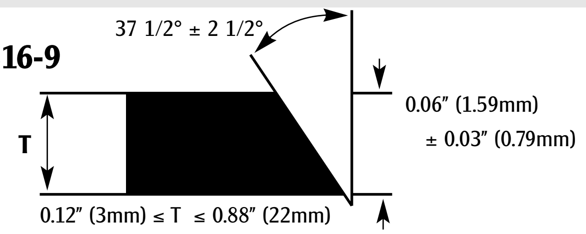
MSS SP-43

Nominal Pipe Size	All Fittings		90° Elbows 45 Elbows Tees	Reducers Lap Joint Stub Ends	180° Returns			Caps	Lap-Joint Stub Ends	
	Outside Diameter at Welding End	Wall Thickness	Center-to End Dimension ABCM	Overall Length FH	Center-to Centre Dimension P	Back-to-Face Dimension K	Alignment of End U	Over Length E	Fillet Radius of Lap A	Outside Diameter of Lap G
1/2 to 11/2	± 0.76	Not less than 87.5% of nominal thickness	± 1.52	± 1.52	± 6.35	± 6.35	± 0.76	± 3.05	+0 -0.76	+0 -0.76
2 to 3 1/2	±0.76		±1.52	±1.52	±6.35	±6.35	±0.76	±3.05	+0 -0.76	+0 -0.76
4	±0.76		±1.52	±1.52	±6.35	±6.35	±0.76	±3.05	+0 -1.52	+0 -0.76
5 to 8	+1.52 -0.76		±1.52	±1.52	±6.35	±6.35	±0.76	±6.35	+0 -1.52	+0 -0.76
10 to 18	+2.29 -0.76		±2.29	±2.29	±9.65	±6.35	±1.52	±6.35	+0 -1.52	+0 -1.52
20 to 24	+3.05 -0.76		±2.29	±2.29	±9.65	±6.35	±1.52	±6.35	+0 -1.52	+0 -1.52

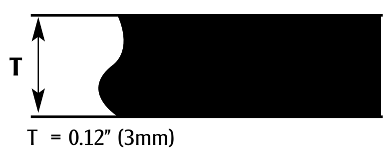
ANSI B16-9

All Fittings				90° and 45 " Elbows and Tees	Reducers and Lap Joint Stub Ends	Caps	180° Returns			Lap-Joint Stub Ends		
Nominal Pipe Size	Outside Diameter at Bevel	Inside Diameter at End	Wall Thickness	Center-to End Dimension A B C M	Overall Length F H	Overall Length E	Center-to Centre Dimension P	Back-to-Face Dimension K	Alignment of End U	Outside Diameter of Lap G	Thickness of Lap T	Fillet Radius of Lap R
1/2 to 21/2	+1.52 -0.76	±0.76	Not less than 87.5% of nominal thickness	±1.52	±1.52	±3.05	±6.35	±6.35	±0.76	+0 -0.76	+1.52 -0	+0 -0.76
3 to 3 1/2	±1.52	±1.52		±1.52	±1.52	±3.05	±6.35	±6.35	±0.76	+0 -0.76	+1.52 -0	+0 -0.76
4+1.52	±1.52	±1.52		±1.52	±3.05	±6.35	±6.35	±0.76	+0 -0.76	+1.52 -0	+0 -1.52	
5 to 8	+2.29 -1.52	±1.52		±1.52	±1.52	±6.35	±6.35	±6.35	±0.76	+0 -0.76	+1.52 -0	+0 -1.52
10 to 18	+4.06 -3.05	±3.05		±2.29	±2.29	±6.35	±9.65	±6.35	±1.52	+0 -1.52	+1.52 -0	+0 -1.52
20 to 24	+6.35 -4.83	±4.83		±2.29	±2.29	±6.35	±9.65	±6.35	±1.52	+0 -1.52	+1.52 -0	+0 -1.52
26 to 30	+6.35 -4.83	±4.83		±3.05	±4.83	±9.65						
32 to 48	+6.35 -4.83	±4.83		±4.83	±4.83	±9.65						

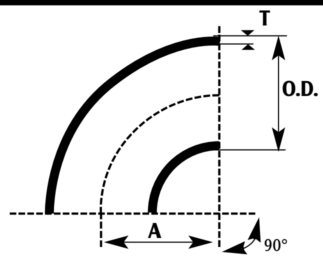
ANSI B16-9



BEVEL



ASME/ASTM SA/A 403 WPS (Seamless) ANSI B-16-9
ASME/ASTM SA/A 403 WPW (Welded) ANSI B16-9
ASME/ASTM SA/A 403 WPWX (Welded/100% x Ray) ANSI B16-9



Dimensions (unit: mm)

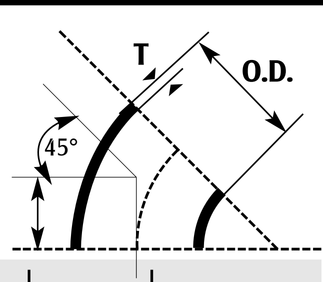
Nominal Pipe Size	Outside Dia. (OD)	Wall Thickness (T) Sch. 5S	Sch. 10S	STD Sch. 40S	XS Sch. 80 S	Centre to End (A)
1/2	21.34	1.65	2.11	2.77	3.73	38.10
3/4	26.67	1.65	2.11	2.87	3.91	28.45
1	33.4	1.65	2.77	3.38	4.55	38.10
1 1/4	42.16	1.65	2.77	3.56	4.85	47.75
1 1/2	48.26	1.65	2.77	3.68	5.08	5.15
2	60.32	1.65	2.77	3.91	5.54	76.20
2 1/2	73.02	2.11	3.05	5.16	7.01	95.25
3	88.90	2.11	3.05	5.49	7.62	114.3
3 1/2	10.60	2.11	3.05	5.74	8.08	133.35
4	114.30	2.11	3.05	6.02	8.56	152.4
5	141.30	2.77	3.40	6.55	9.53	190.50
6	168.27	2.77	3.40	7.11	10.97	228.60
8	219.08	2.77	3.796	8.18	12.7	304.80
10	273.05	3.40	4.19	9.27	12.70	381.00
12	323.85	3.96	4.57	9.53	12.70	457.20
14	355.60	4.78	7.92	9.53	12.70	533.40
16	406.40	4.78	7.92	9.53	12.70	609.60
18	457.20	4.78	7.92	9.53	12.70	685.80
20	508.00	5.54	9.53	9.53	12.70	762.00
22	558.80	5.54	9.53	9.53	12.70	838.20
24	609.60	6.35	9.53	9.53	12.70	914.40
26	660.40	7.92	12.70	9.53	12.70	990.60
28	711.20	7.92	12.70	9.53	12.70	1066.80
30	762.00	7.92	12.70	9.53	12.70	1143.00
32	812.80	7.92	12.70	9.53	12.70	1219.20
34	863.60	7.92	12.70	9.53	12.70	1295.40
36	914.40	7.92	12.70	9.53	12.70	1371.60
38	965.20	7.92		9.53	12.70	1447.80
40	1016.00	7.92		9.53	12.70	1524.00
42	1066.80	7.92		9.53	12.0	1600.20
44	1117.60	7.92		9.53	12.70	1676.40
46	1168.40	7.92		9.53	12.70	1752.60
48	1219.20	7.92		9.53	12.70	1828.80

Note: Sch40S and 80S apply up to 12" only

Weights (unit: kg)

Nominal Pipe Size	STD Sch. 5S	XS Sch. 10S	Sch. 40S	Sch. 80S
1/2	0.049	0.061	0.078	0.100
3/4	0.062	0.078	0.103	0.104
1	0.078	0.128	0.154	0.204
1 1/4	0.125	0.206	0.260	0.349
1 1/2	0.170	0.283	0.368	0.507
2	0.286	0.478	0.652	0.938
2 1/2	0.576	0.812	1.37	1.79
3	0.810	1.140	2.04	2.87
3 1/2	1.08	1.53	2.82	4.10
4	1.39	1.97	3.84	5.62
5	2.83	3.42	6.48	9.69
6	4.06	4.87	9.94	15.99
8	7.06	10.00	20.10	32.16
10	13.20	15.50	35.40	49.83
12	22.30	25.90	56.20	72.48
14	34.60	57.58	66.36	85.53
16	45.20	70.03	87.11	112.34
18	57.30	89.01	110.67	142.79
20	82.00	136.99	136.99	176.90
22	99.40	163.03	163.03	210.83
24	136.00	198.05	198.05	256.13
26	198.00	296.76	229.17	296.53
28	230.00	345.05	266.50	344.96
30	264.00	397.15	306.59	396.74
32	301.00	453.00	349.53	452.68
34	339.00	512.16	395.24	511.98
36	381.00	575.13	443.71	574.95
38	425.00		497.71	644.75
40	471.00		551.98	715.51
42	520.00		606.16	785.77
4	571.00		669.04	867.40
46	624.00		7.31.69	948.81
48	679.00		797.28	1033.84

ASME/ASTM SA/A 403 WPS (Seamless) ANSI B-16-9
ASME/ASTM SA/A 403 WPW (Welded) ANSI B16-9
ASME/ASTM SA/A 403 WPWX (Welded/100% x Ray) ANSI B16-9



Dimensions (unit: mm)

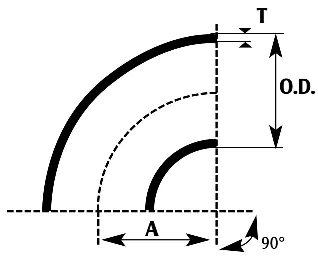
Nominal Pipe Size	Outside Dia. (OD)	Wall Thickness (T)				Centre to End (A)
		Sch. 5S	Sch. 10S	STD Sch. 40S	XS Sch. 80 S	
1/2	21.34	1.65	2.11	2.77	3.73	15.88
3/4	26.67	1.65	2.11	2.87	3.91	11.13
1	33.40	1.65	2.77	3.38	4.55	22.22
1 1/4	42.16	1.65	2.77	3.56	4.85	25.40
1 1/2	48.26	1.65	2.77	3.68	5.08	28.45
2	60.32	1.65	2.77	3.91	5.54	35.05
2 1/2	73.02	2.11	3.05	5.16	7.01	44.45
3	88.90	2.11	3.05	5.49	7.62	50.80
3 1/2	101.60	2.11	3.05	5.74	8.08	57.15
4	114.30	2.11	3.05	6.02	8.56	63.50
5	141.30	2.77	3.40	6.55	9.53	79.25
6	168.27	2.77	3.40	7.11	10.97	95.25
8	219.08	2.77	3.76	8.18	12.70	127.00
10	273.05	3.40	4.19	9.27	12.70	158.75
12	323.85	3.96	4.57	9.53	12.70	190.50
14	355.60	4.78	7.92	9.53	12.70	222.25
16	406.40	4.78	7.92	9.53	12.70	254.00
18	457.20	4.78	7.92	9.53	12.70	285.75
20	508.00	5.54	9.53	9.53	12.70	317.50
22	558.80	5.54	9.53	9.53	12.70	342.90
24	609.60	6.35	9.53	9.53	12.70	381.00
26	660.40	7.92	12.70	9.53	12.70	406.40
28	711.20	7.92	12.70	9.53	12.70	438.15
30	762.00	7.92	12.70	9.53	12.70	469.90
32	812.80	7.92	12.70	9.53	12.70	501.65
34	863.60	7.92	12.70	9.53	12.70	533.40
36	914.40	7.92	12.70	9.53	12.70	565.15
38	965.20	7.92		9.53	12.70	599.95
40	1016.00	7.92		9.53	12.70	631.95
42	1066.80	7.92		9.53	12.70	660.40
44	1117.60	7.92		9.53	12.70	695.45
46	1168.40	7.92		9.53	12.70	726.95
48	1219.20	7.92		9.53	12.70	758.95

Note: Sch40S and 80S apply up to 12″ only

Weights (unit: kg)

Nominal Pipe Size	STD Sch. 5S	XS Sch. 10S	Sch. 40S	Sch. 80S
1/2	0.024	0.030	0.039	0.050
3/4	0.031	0.039	0.052	0.078
1	0.039	0.064	0.077	0.100
1 1/4	0.063	0.103	0.130	0.177
1 1/2	0.085	0.142	0.184	0.254
2	0.143	0.239	0.326	0.471
2 1/2	0.288	0.406	0.683	0.897
3	0.405	0.571	1.02	1.44
3 1/2	0.540	0.764	1.41	2.05
4	0.696	0.985	1.92	2.81
5	1.42	1.71	3.24	4.85
6	2.01	2.43	4.97	8.02
8	3.53	5.01	10.10	16.22
10	6.62	7.77	17.70	25.37
12	11.10	12.50	28.10	36.69
14	17.30	28.63	32.93	42.40
16	22.60	34.84	43.31	55.76
18	28.70	44.21	54.99	70.94
20	41.00	68.13	68.13	88.02
22	49.70	81.13	81.13	104.87
24	68.00	98.57	98.57	127.52
26	99.00	147.63	114.11	147.68
28	115.00	171.82	132.73	171.82
30	132.00	197.78	152.75	197.78
32	151.00	225.59	156.24	225.59
34	170.00	255.22	196.96	255.13
36	191.00	286.66	221.20	286.57
38	213.00		248.15	321.58
40	236.00		257.35	356.69
42	260.00		301.34	391.85
44	286.00		333.68	432.66
46	312.00		365.07	473.25
48	340.00		397.69	515.74

ASME/ASTM SA/A 403 WPS (Seamless) ANSI B-16-9
ASME/ASTM SA/A 403 WPW (Welded) ANSI B16-9
ASME/ASTM SA/A 403 WPWX (Welded/100% x Ray) ANSI B16-9



Dimensions (unit: mm)

Nominal Pipe Size	Outside Dia. (OD)	Wall Thickness (T) Sch. 5S	Sch. 10S	STD Sch. 40S	XS Sch. 80 S	Centre to End (A)
1	33,40	1,65	2,77	3,38	4,55	25,40
1 1/4	42,16	1,65	2,77	3,56	4,85	31,75
1 1/2	48,26	1,65	2,77	3,68	5,08	38,10
2	60,32	1,65	2,77	3,91	5,54	50,80
2 1/2	73,02	2,11	3,05	5,16	7,01	63,50
3	88,90	2,11	3,05	5,49	7,62	76,20
3 1/2	101,60	2,11	3,05	5,74	8,08	88,90
4	114,30	2,11	3,05	6,02	8,56	101,60
5	141,30	2,77	3,40	6,55	9,53	27,00
6	168,27	2,77	3,40	7,11	10,97	152,40
8	219,08	2,77	3,76	8,18	12,70	203,20
10	273,05	3,40	4,19	9,27	12,70	254,00
12	323,85	3,96	4,57	9,53	12,70	304,80
14	355,60	3,96	4,78	9,53	12,70	355,60
16	406,40	3,96	4,78	9,53	12,70	406,40
18	457,20	3,96	4,78	9,53	12,70	457,20
20	508,00	4,78	5,54	9,53	12,70	508,00
22	558,80	4,78	5,54	9,53	12,70	558,80
24	609,60	5,54	6,35	9,53	12,70	609,60

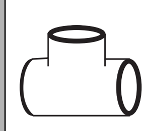
Weights (unit: kg)

Nominal Pipe Size	STD Sch. 5S	XS Sch. 10S	Sch. 40S	Sch. 80S
1	0,077	0,094	0,118	0,122
1 1/4	0,101	0,152	0,204	0,217
1 1/2	0,114	0,189	0,245	0,317
2	0,191	0,318	0,434	0,593
2 1/2	0,383	0,541	0,909	1,13
3	0,540	0,761	1,36	1,82
3 1/2	0,719	1,02	1,88	2,61
4	0,928	1,31	2,56	3,56
5	1,89	2,28	4,32	6,20
6	2,68	3,24	6,63	10,26
8	4,71	6,68	12,40	20,84
10	8,83	10,40	23,60	32,94
12	14,80	16,70	37,50	47,30
14	15,21	24,55	48,33	59,25
16	25,60	32,00	63,37	81,81
18	40,40	40,40	73,57	103,96
20	40,42	60,25	99,66	128,79
22	61,06	73,02	120,83	156,29
24	86,98	101,56	144,06	186,41

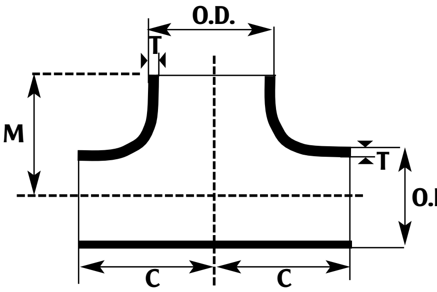
Note: Sch40S and 80S apply up to 12" only



Equal Tees



ASME/ASTM SA/A 403 WPS (Seamless) ANSI B-16-9
ASME/ASTM SA/A 403 WPW (Welded) ANSI B16-9
ASME/ASTM SA/A 403 WPWX (Welded/100% x Ray) ANSI B16-9



Dimensions (unit: mm)

Nominal Pipe Size	Outside Dia. (OD)	Wall Thickness (T)				Centre to End (A)
		Sch. 5S	Sch. 10S	STD Sch. 40S	XS Sch. 80 S	
1/2	21,34	1,65	2,11	2,77	3,73	25,40
3/4	26,67	1,65	2,11	2,87	3,91	28,70
1	33,40	1,65	2,77	3,38	4,55	38,10
1 1/4	42,16	1,65	2,77	3,56	4,85	47,75
1 1/2	48,26	1,65	2,77	3,68	5,08	57,15
2	60,32	1,65	2,77	3,91	5,54	63,50
2 1/2	73,02	2,11	3,05	5,16	7,01	76,20
3	88,90	2,11	3,05	5,49	7,62	85,85
4	114,30	2,11	3,05	6,02	8,56	104,90
5	141,30	2,77	3,40	6,55	9,53	123,95
6	168,27	2,77	3,40	7,11	10,97	143,00
8	219,08	2,77	3,76	8,18	12,70	177,80
10	273,05	3,40	4,19	9,27	12,70	215,90
12	323,85	3,96	4,57	9,53	12,70	254,00
14	355,60	3,96	4,78	9,53	12,70	279,40
16	406,40	3,96	4,78	9,53	12,70	304,80
18	457,20	3,96	4,78	9,53	12,70	342,90
20	508,00	4,78	5,54	9,53	12,70	381,00
22	558,80	4,78	5,54	9,53	12,70	419,10
24	609,60	5,54	6,35	9,53	12,70	431,80

Weights (unit: kg)

Nominal Pipe Size	STD Sch. 5S	XS Sch. 10S	Sch. 40S	Sch. 80S
1/2	0,090	0,090	0,181	0,204
3/4	0,129	0,128	0,258	0,294
1	0,223	0,223	0,256	0,399
1 1/4	0,356	0,356	0,463	0,725
1 1/2	0,497	0,497	0,648	1,02
2	0,681	0,681	0,893	1,81
2 1/2	1,20	1,20	1,98	3,17
3	1,57	1,57	2,61	3,85
4	2,46	2,46	4,76	7,11
5	4,04	4,04	7,84	11,78
6	5,50	5,50	9,54	18,12
8	11,07	11,07	19,56	33,98
10	19,87	19,87	32,61	47,57
12	27,86	27,86	56,65	72,48
14	28,74	35,98	71,21	91,78
16	35,69	44,69	88,56	114,23
18	45,21	56,62	112,33	144,98
20	69,97	83,69	138,99	179,66
22	84,72	101,35	170,07	217,46
24	113,23	132,24	192,66	243,13

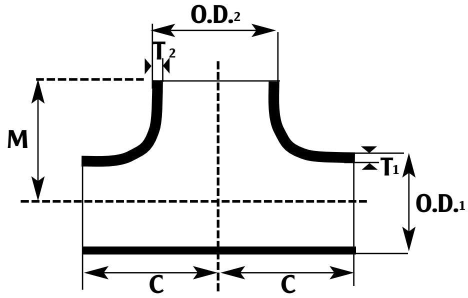
Note: Sch40S and 80S apply up to 12" only







ASME/ASTM SA/A 403 WPS (Seamless) ANSI B-16-9
ASME/ASTM SA/A 403 WPW (Welded) ANSI B16-9
ASME/ASTM SA/A 403 WPWX (Welded/100% x Ray) ANSI B16-9



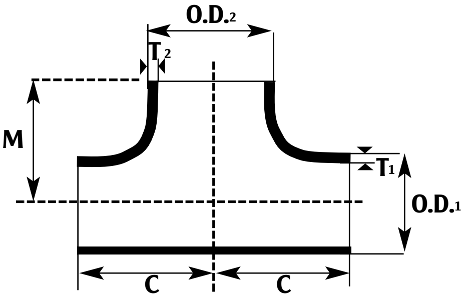
Dimensions (unit: mm)

Nom. Pipe Size Run	Out let	Out-Side Dia. OD1	Out-Side Dia. OD2	Wall Thickness (T1, T2) Sch. 5S T1	Sch. 5S T2	Sch. 10S T1	Sch. 10S T2	STD Sch. 40S T1	STD Sch. 40S T2	XS Sch. 80S T1	XS Sch. 80S T2	Center to End C	Center to End M
3/4	1/2	26,67	21,34	1,65	1,65	2,11	2,11	2,87	2,77	3,91	3,73	28,70	28,70
1	1/2	33,40	21,34	1,65	1,65	2,77	2,11	3,38	2,77	4,55	3,73	38,10	38,10
1	3/4	33,40	26,67	1,65	1,65	2,77	2,11	3,38	2,87	4,55	3,91	38,10	38,10
1 1/4	3/4	42,16	26,67	1,65	1,65	2,77	2,11	9,56	2,87	4,85	3,91	47,75	47,75
1 1/4	1	42,16	33,40	1,65	1,65	2,77	2,77	3,56	3,38	4,85	4,55	47,75	47,75
1 1/2	1/2	48,26	21,34	1,65	1,65	2,77	2,11	3,68	2,77	5,08	3,73	57,15	57,15
1 1/2	3/4	48,26	26,67	1,65	1,65	2,77	2,11	3,68	2,87	5,08	3,91	57,15	57,15
1 1/2	1	48,26	33,40	1,65	1,65	2,77	2,77	3,68	3,38	5,08	4,55	57,15	57,15
1 1/2	1 1/4	48,26	42,16	1,65	1,65	2,77	2,77	3,68	3,56	5,08	4,85	57,15	57,15
2	3/4	60,32	26,67	1,65	1,65	2,77	0,84	3,91	2,87	5,54	3,91	63,50	44,45
2	1	60,32	33,40	1,65	1,65	2,77	2,77	3,91	3,38	5,54	4,55	63,50	50,80
2	1 1/4	60,32	42,16	1,65	1,65	2,77	2,77	3,91	3,56	5,54	4,85	63,50	57,15
2	1 1/2	60,32	48,26	1,65	1,65	2,77	2,77	3,91	3,68	5,54	5,08	63,50	60,45
2 1/2	1 1/2	73,02	48,26	2,11	1,65	3,05	2,77	5,16	3,68	7,01	5,08	76,20	66,80
2 1/2	2	73,02	60,32	2,11	1,65	3,05	2,77	5,16	3,91	7,01	5,54	76,20	69,85
3	1 1/2	88,90	48,26	2,11	1,65	3,05	2,77	5,49	3,68	7,62	5,08	79,50	73,15
3	2	88,90	60,32	2,11	1,65	3,05	2,77	5,49	3,91	7,62	5,54	85,85	76,20
3	2 1/2	88,90	73,02	2,11	2,11	3,05	3,05	5,49	5,16	7,62	7,01	85,85	82,55
4	1 1/2	114,30	48,26	2,11	1,65	3,05	2,77	6,02	3,68	8,56	5,08	104,90	85,85
4	2	114,30	60,32	2,11	1,65	3,05	2,77	6,02	3,91	8,56	5,54	104,90	88,90
4	2 1/2	114,30	73,02	2,11	2,11	3,05	3,05	6,02	5,16	8,56	7,01	104,90	95,25
4	3	114,30	88,90	2,11	2,11	3,05	3,05	6,02	5,49	8,56	7,62	104,90	98,55
5	3	141,30	88,90	2,77	2,11	3,40	3,05	6,55	5,49	9,53	7,62	123,95	111,25
5	4	141,30	114,30	2,77	2,11	3,40	3,05	6,55	6,02	9,53	8,56	123,95	117,60
6	2 1/2	168,27	73,02	2,77	2,11	3,40	3,05	7,11	5,16	10,97	7,01	143,00	120,65
6	3	168,27	88,90	2,77	2,11	3,40	3,05	7,11	5,49	10,97	7,62	143,00	123,95
6	4	168,27	114,30	2,77	2,11	3,40	3,05	7,11	6,02	10,97	8,56	143,00	130,30
6	5	168,27	141,30	2,77	2,77	3,40	9,40	7,11	6,55	10,97	9,53	143,00	136,65

Weights (unit: kg)

Nominal Pipe Size Run	Out-let	Sch. 5S	Sch. 10S	STD Sch. 40S	XS Sch. 80S
3/4	1/2	0,083	0,123	0,200	0,230
1	1/2	0,187	0,204	0,234	0,349
1	3/4	0,187	0,212	0,244	0,353
1 1/4	3/4	0,290	0,327	0,423	0,612
1 1/4	1	0,312	0,339	0,441	0,643
1 1/2	1/2	0,397	0,431	0,561	0,897
1 1/2	3/4	0,397	0,446	0,578	0,901
1 1/2	1	0,421	0,461	0,600	0,929
1 1/2	1 1/4	0,422	0,482	0,629	0,978
2	3/4	0,625	0,702	1,11	1,44
2	1	0,643	0,725	1,14	1,46
2	1 1/4	0,680	0,747	1,18	1,51
2	1 1/2	0,734	0,766	1,23	1,57
2 1/2	1 1/2	0,824	1,18	2,08	2,61
2 1/2	2	0,838	1,21	2,12	2,66
3	1 1/2	1,33	1,60	2,98	3,84
3	2	1,42	1,63	3,01	3,86
3	2 1/2	1,58	1,69	3,15	3,97
4	1 1/2	2,45	2,51	5,04	6,63
4	2	2,47	2,53	5,08	6,70
4	2 1/2	2,52	2,59	5,22	6,79
4	3	2,55	2,61	5,27	6,93
5	3	3,38	4,17	8,13	10,95
5	4	3,43	4,24	8,36	11,18
6	2 1/2	4,62	5,69	11,87	17,05
6	3	4,67	5,075	11,92	17,07
6	4	4,75	5,85	12,10	17,19
6	5	4,80	5,92	12,34	17,47

Note: Sch40S and 80S apply up to 12" only



ASME/ASTM SA/A403 WPS (Seamless) ANSI B 16.9
ASME/ASTM SA/A403 WPW (Welded) ANSI B 16.9
ASME/ASTM SA/A403 WPWX (Welded/100% X Ray) ANSI B 16.9

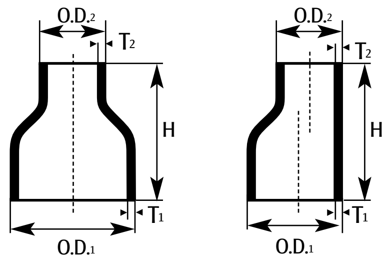
Dimensions (unit: mm)

Nom. Pipe Size Run	Out-let	Out-Side Dia. OD_1	Out-Side Dia. OD_2	Wall Thickness (T_1, T_2) Sch.5S T_1	Sch.5S T_2	Sch.10S T_1	Sch.10S T_2	STD Sch.40S T_1	STD Sch.40S T_2	XS Sch.80S T_1	XS Sch.80S T_2	Center to End C	Center to End M
8	4	219.08	114.30	2.77	2.11	3.76	3.05	8.18	6.02	12.70	8.56	177.80	155.70
8	5	219.08	141.30	2.77	2.77	3.76	3.40	8.18	6.55	12.70	9.53	177.80	162.05
8	6	219.08	168.27	2.77	2.77	3.76	3.40	8.18	7.11	12.70	10.97	177.80	168.40
10	5	273.05	141.30	3.40	2.77	4.19	3.40	9.27	6.55	12.70	9.53	215.90	190.50
10	6	273.05	168.27	3.40	2.77	4.19	3.40	9.27	7.11	12.70	10.97	215.90	193.80
10	8	273.05	219.08	3.40	2.77	4.19	3.76	9.27	8.18	12.70	12.70	215.90	203.20
12	6	323.85	168.27	3.96	2.77	4.57	3.40	9.53	7.11	12.70	10.97	254.00	219.20
12	10	323.85	273.05	3.96	2.64	4.57	4.19	9.53	9.27	12.70	12.70	254.00	241.30
14	8	355.60	219.08	4.78	3.76	7.92	6.35	9.53	8.18	12.70	12.70	279.40	247.65
14	10	355.60	273.05	4.78	4.09	7.92	6.35	9.53	9.27	12.70	12.70	279.40	257.30
14	12	355.60	323.85	4.78	4.57	7.92	6.35	9.53	9.53	12.70	12.70	279.40	270.00
16	10	406.40	273.05	4.78	4.19	7.92	6.35	9.53	9.27	12.70	12.70	304.80	282.70
16	12	406.40	323.85	4.78	4.57	7.92	6.35	9.53	9.53	12.70	12.70	304.80	295.40
16	14	406.40	335.60	4.78	4.78	7.92	7.92	9.53	9.53	12.70	12.70	304.80	304.80
18	12	457.20	323.85	4.78	4.57	7.92	6.35	9.53	9.53	12.70	12.70	342.90	320.80
18	14	457.20	355.60	4.78	4.78	7.92	7.92	9.53	9.53	12.70	12.70	342.90	330.20
18	16	457.20	406.40	4.78	4.78	7.92	7.92	9.53	9.53	12.70	12.70	342.90	330.20
20	14	508.00	355.60	5.54	4.78	9.53	7.92	9.53	9.53	12.70	12.70	381.00	355.60
20	16	508.00	406.40	5.54	4.78	9.53	7.92	9.53	9.53	12.70	12.70	381.00	355.60
20	18	508.00	457.20	5.54	4.78	9.53	7.92	9.53	9.53	12.70	12.70	381.00	368.30
22	16	558.80	406.40	5.54	4.78	9.53	7.92	9.53	9.53	12.70	12.70	419.10	381.00
22	18	558.80	457.20	5.54	4.78	9.53	7.92	9.53	9.53	12.70	12.70	419.10	393.70
22	20	558.80	508.00	5.54	5.54	9.53	9.53	9.53	9.53	12.70	12.70	419.10	406.40
24	16	609.60	406.40	6.35	4.78	9.53	7.92	9.53	9.53	12.70	12.70	431.80	406.40
24	18	609.60	457.20	6.35	4.78	9.53	7.92	9.53	9.53	12.70	12.70	431.80	419.10
24	20	609.60	508.00	6.35	5.54	9.53	9.53	9.53	9.53	12.70	12.70	431.80	431.80
24	22	609.60	558.80	6.35	5.54	9.53	9.53	9.53	9.53	12.70	12.70	431.80	431.80

Note: Sch 40S and 80S apply up to 12″ only

Weights (unit: kg)

Nominal Pipe Size Run	Out-let	Sch. 5S	Sch. 10S	STD Sch. 40S	XS Sch. 80S
8	4	7.35	9.80	21.26	30.76
8	5	7.41	9.83	21.36	30.85
8	6	7.44	9.90	21.62	31.25
10	5	13.43	16.47	36.14	47.47
10	6	13.49	16.58	36.27	47.95
10	8	13.54	16.69	36.85	48.39
12	6	22.93	25.10	51.96	67.43
12	10	23.13	25.48	53.72	68.81
14	8	28.79	52.00	57.88	75.22
14	10	28.96	52.37	58.34	75.89
14	12	29.14	52.73	58.81	76.57
16	10	34.26	61.89	68.88	89.51
16	12	34.47	62.32	69.43	90.32
16	14	34.67	62.76	69.98	91.12
18	12	43.37	78.33	87.17	113.28
18	14	43.62	78.88	87.87	114.30
18	16	43.89	79.43	88.57	115.33
20	14	64.47	107.63	107.63	139.86
20	16	64.85	108.38	108.38	141.12
20	18	65.24	109.24	109.14	142.39
22	16	78.00	130.23	130.23	169.22
22	18	78.47	131.14	131.14	170.74
22	20	78.94	132.06	132.06	172.88
24	16	96.84	138.24	138.24	179.64
24	18	97.69	139.21	139.21	181.25
24	20	98.00	140.18	140.18	182.89
24	22	98.59	141.16	141.16	184.53



ASME/ASTM SA/A403 WPS (Seamless) ANSI B 16.9
ASME/ASTM SA/A403 WPW (Welded) ANSI B 16.9
ASME/ASTM SA/A403 WPWX (Welded/100% X Ray) ANSI B 16.9

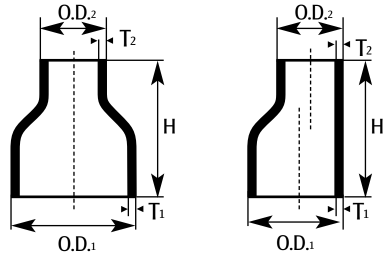
Dimensions (unit: mm)

Nominal Pipe Size		Out-Side Dia. OD_1	Out-Side Dia. OD_2	Wall Thickness Sch. 5S T_1	Sch. 5S T_2	Sch. 10S T_1	Sch. 10S T_2	STD Sch. 40S T_1	STD Sch. 40S T_2	XS Sch. 80S T_1	XS Sch. 80S T_2	Length H
3/4	1/2	26.67	21.34	1.65	1.65	2.11	2.11	2.87	2.77	3.91	3.73	38.10
1	1/2	33.40	21.34	1.65	1.65	2.77	2.11	3.38	2.77	4.55	3.73	50.80
1	3/4	33.40	26.67	1.65	1.65	2.77	2.11	3.38	2.87	4.55	3.91	50.80
1 1/4	1	42.16	33.40	1.65	1.65	2.77	2.77	3.56	3.38	4.85	4.55	50.80
1 1/2	1/2	48.26	21.34	1.65	1.65	2.77	2.11	3.68	2.77	5.08	3.73	63.50
1 1/2	3/4	48.26	26.67	1.65	1.65	2.77	2.11	3.68	2.87	5.008	3.91	63.50
1 1/2	1	48.26	33.40	1.65	1.65	2.77	2.77	3.68	3.38	5.08	4.55	63.50
1 1/2	1 1/4	48.26	42.16	1.65	1.65	2.77	2.77	3.68	3.56	5.08	4.85	63.50
2	3/4	60.32	26.67	1.65	1.65	2.77	2.11	3.91	2.87	5.54	3.91	76.20
2	1	60.32	33.40	1.65	1.65	2.77	2.77	3.91	3.38	5.54	4.55	76.20
2	1 1/4	60.32	42.16	1.65	1.65	2.77	2.77	3.91	3.56	5.54	4.85	76.20
2	1 1/2	60.32	48.26	1.65	1.65	2.77	2.77	3.91	3.68	5.54	5.08	76.20
2 1/2	1	73.02	33.40	2.11	1.65	3.05	2.77	5.16	3.38	7.01	4.55	88.90
2 1/2	1 1/4	73.02	42.16	2.11	1.65	3.05	2.77	5.16	3.56	7.01	4.85	88.90
2 1/2	1 1/2	73.02	48.26	2.11	1.65	3.05	2.77	5.16	3.68	7.01	5.08	88.90
2 1/2	2	73.02	60.32	2.11	1.65	3.05	2.77	5.16	3.91	7.01	5.54	88.90
3	1	88.90	33.40	2.11	1.65	3.05	2.77	5.49	3.38	7.62	4.55	88.90
3	1 1/4	88.90	42.16	2.11	1.65	3.05	2.77	5.49	3.56	7.62	4.85	88.90
3	1 1/2	88.90	48.26	2.11	1.65	3.05	2.77	5.49	3.68	7.62	5.08	88.90
3	2	88.90	60.32	2.11	1.65	3.05	2.77	5.49	3.91	7.62	5.54	88.90
3	2 1/2	88.90	73.02	2.11	2.11	3.05	3.05	5.49	5.16	7.62	7.01	88.90
4	1 1/2	114.30	48.26	2.11	1.65	3.05	2.77	6.02	3.68	8.56	5.08	101.60
4	2	114.30	60.32	2.11	1.65	3.05	2.77	6.02	3.91	8.56	5.54	101.60
4	2 1/2	114.30	73.02	2.11	2.11	3.05	3.05	6.02	5.16	8.56	7.01	101.60
4	3	114.30	88.90	2.11	2.11	3.05	3.05	6.02	5.49	8.56	7.62	101.60
5	3	141.30	88.90	2.77	2.11	3.40	3.05	6.55	5.49	9.53	7.62	127.00
5	4	141.30	114.30	2.77	2.11	3.40	3.05	6.55	6.02	9.53	8.56	127.00
6	2 1/2	168.27	73.02	2.77	2.11	3.40	3.05	7.11	5.16	10.97	7.01	139.70
3	3	168.27	88.90	2.77	2.11	3.40	3.05	7.11	5.49	10.97	7.62	139.70
6	4	168.27	114.30	2.77	2.11	3.40	3.05	7.11	6.02	10.97	8.56	139.70
6	5	168.27	141.30	2.77	2.77	3.40	3.40	7.11	6.55	10.97	9.53	139.70
8	4	219.08	114.30	2.77	2.11	3.76	3.05	0.18	6.02	12.70	8.56	152.40
8	5	219.08	141.30	2.77	2.77	3.76	3.40	0.18	6.55	12.70	9.53	152.40
8	6	219.08	168.27	2.77	2.77	3.76	3.40	0.18	7.11	12.70	10.97	152.40
10	5	273.05	141.30	3.40	2.77	4.19	3.40	9.27	6.55	12.70	9.53	177.80
10	6	273.05	168.27	3.40	2.77	4.19	3.40	9.27	7.11	12.70	10.97	177.80
10	8	273.05	219.08	3.40	2.77	4.19	3.76	9.27	8.18	12.70	12.70	177.80
12	6	323.85	168.27	3.96	2.77	4.57	3.40	9.53	7.11	12.70	10.97	203.20
12	8	323.85	219.08	3.96	2.77	4.57	3.76	9.53	8.18	12.70	12.70	203.20
12	10	323.85	273.05	3.96	3.40	4.57	4.19	9.53	9.27	12.70	12.70	203.20

Weights (unit: kg)

Nominal Pipe Size		Sch. 5S	Sch. 10S	STD Sch. 40S	XS Sch. 80S
3/4	1/2	0.054	0.090	0.105	0.159
1	1/2	0.060	0.089	0.105	0.163
1	3/4	0.060	0.098	0.116	0.168
1 1/4	1	0.066	0.125	0.157	0.245
1 1/2	1/2	0.091	0.154	0.204	0.276
1 1/2	3/4	0.095	0.156	0.201	0.294
1 1/2	1	0.103	0.170	0.219	0.308
1 1/2	1 1/4	0.118	0.195	0.263	0.331
2	3/4	0.121	0.214	0.298	0.458
2	1	0.143	0.237	0.322	0.458
2	1 1/4	0.156	0.258	0.352	0.525
2	1 1/2	0.164	0.273	0.372	0.544
2 1/2	1	0.453	0.349	0.793	0.793
2 1/2	1 1/4	0.276	0.394	0.670	0.825
2 1/2	1 1/2	0.281	0.396	0.661	0.856
2 1/2	2	0.307	0.432	0.724	0.938
3	1	0.281	0.408	0.716	0.888
3	1 1/4	0.299	0.430	0.775	1.037
3	1 1/2	0.315	0.444	0.783	1.105
3	2	0.339	0.478	0.846	1.178
3	2 1/2	0.376	0.548	0.983	1.291
4	1 1/2	0.435	0.630	1.241	1.730
4	2	0.464	0.656	1.27	1.780
4	2 1/2	0.499	0.706	1.37	2.007
4	3	0.528	0.748	1.45	2.129
5	3	0.991	1.20	2.27	3.547
5	4	1.107	1.32	2.50	3.769
6	2 1/2	1.12	1.35	2.74	4.51
6	3	1.24	1.50	3.04	5.03
6	4	1.34	1.62	3.30	5.44
6	5	1.45	1.75	3.57	5.71
8	4	1.80	2.56	5.10	8.43
8	5	1.90	2.70	5.40	8.83
8	6	2.01	2.85	5.71	9.24
10	5	2.82	3.30	8.21	13.00
10	6	3.30	3.87	8.78	13.50
10	8	3.59	4.21	9.58	14.22
12	6	4.97	5.73	12.40	18.39
12	8	5.45	6.11	13.70	19.07
12	10	5.83	6.55	14.70	19.48

Note: Sch 40S and 80S apply up to 12" only



ASME/ASTM SA/A403 WPS (Seamless) ANSI B 16.9
ASME/ASTM SA/A403 WPW (Welded) ANSI B 16.9
ASME/ASTM SA/A403 WPWX (Welded/100% X Ray) ANSI B 16.9

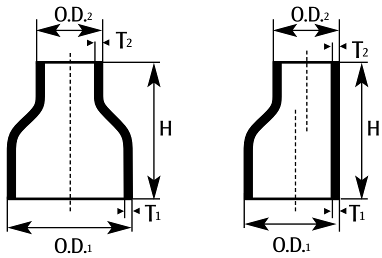
Dimensions (unit: mm)

Nominal Pipe Size		Out-Side Dia. OD_1	Out-Side Dia. OD_2	Wall Thickness (T_1, T_2)								Length
				Sch. 10S		Sch. 20		STD Sch. 40S		XS Sch. 80S		H
				T_1	T_2	T_1	T_2	T_1	T_2	T_1	T_2	
14	12	355.60	323.85	4.78	4.57	7.92	6.35	9.53	9.53	12.70	12.70	330.20
14	10	355.60	273.05	4.78	4.19	7.92	6.35	9.53	9.27	12.70	12.70	330.20
14	8	355.60	219.08	4.78	3.76	7.92	6.35	9.53	8.18	12.70	12.70	330.20
14	6	355.60	168.27	4.78	3.40	7.92	-	9.53	7.11	12.70	10.97	330.20
16	14	406.40	355.60	4.78	4.78	7.92	7.92	9.53	9.53	12.70	12.70	355.60
16	12	406.40	323.85	4.78	4.57	7.92	6.35	9.53	9.53	12.70	12.70	355.60
16	10	406.40	273.05	4.78	4.19	7.92	6.35	9.53	9.27	12.70	12.70	355.60
16	8	406.40	219.08	4.78	3.76	7.92	6.35	9.53	8.18	12.70	12.70	355.60
18	16	457.20	406.40	4.78	4.78	7.92	7.92	9.53	9.53	12.70	12.70	381.00
18	14	457.20	355.60	4.78	4.78	7.92	7.92	9.53	9.53	12.70	12.70	381.00
18	12	457.20	323.85	4.78	4.57	7.92	6.35	9.53	9.53	12.70	12.70	381.00
18	10	457.20	273.05	4.78	4.19	7.92	6.35	9.53	9.27	12.70	12.70	381.00
20	18	508.00	457.20	5.54	4.78	9.53	7.92	9.53	9.53	12.70	12.70	508.00
20	16	508.00	406.40	5.54	4.78	9.53	7.92	9.53	9.53	12.70	12.70	508.00
20	14	508.00	355.60	5.54	4.78	9.53	7.92	9.53	12.70	12.70	12.70	508.00
20	12	508.00	323.85	5.54	4.57	9.53	6.35	9.53	9.53	12.70	12.70	508.00
22	20	558.80	508.00	5.54	5.54	9.53	9.53	9.53	9.53	12.70	12.70	508.00
20	18	558.80	457.20	5.54	4.78	9.53	7.92	9.53	9.53	12.70	12.70	508.00
22	16	558.80	406.40	5.54	4.78	9.53	7.92	9.53	9.53	12.70	12.70	508.00
22	14	558.80	355.60	5.54	4.78	9.53	7.92	9.53	9.53	12.70	12.70	508.00
24	22	609.60	558.80	6.35	5.54	9.53	9.53	9.53	9.53	12.70	12.70	508.00
24	20	609.60	508.00	6.35	5.54	9.53	9.53	9.53	9.53	12.70	12.70	508.00
24	18	609.60	457.20	6.35	4.78	9.53	7.92	9.53	9.53	12.70	12.70	508.00
24	16	609.60	406.40	6.35	4.78	9.53	7.92	9.53	9.53	12.70	12.70	508.00
24	14	609.60	355.60	6.35	4.78	9.53	7.92	9.53	9.53	12.70	12.70	508.00
26	24	660.40	609.60			12.70	9.53	9.53	9.53	12.70	12.70	609.60
26	20	660.40	508.00			12.70	9.53	9.53	9.53	12.70	12.70	609.60
26	18	660.40	457.20			12.70	7.92	9.53	9.53	12.70	12.70	609.60
26	16	660.40	406.40			12.70	7.92	9.53	9.53	12.70	12.70	609.60
28	26	711.20	660.40			12.70	12.70	9.53	9.53	12.70	12.70	609.60
28	24	711.20	609.60			12.70	9.53	9.53	9.53	12.70	12.70	609.60
28	20	711.20	508.00			12.70	9.53	9.53	9.53	12.70	12.70	609.60
28	18	711.20	457.20			12.70	7.92	9.53	9.53	12.70	12.70	609.60
30	28	762.00	711.20			12.70	12.70	9.53	9.53	12.70	12.70	609.60
30	26	762.00	660.40			12.70	12.70	9.53	9.53	12.70	12.70	609.60
30	24	762.00	609.60			12.70	9.53	9.53	9.53	12.70	12.70	609.60
30	20	762.00	508.00			12.70	9.53	9.53	9.53	12.70	12.70	609.60
32	30	812.80	762.00			12.70	12.70	9.53	9.53	12.70	12.70	609.60
32	28	812.80	711.20			12.70	12.70	9.53	9.53	12.70	12.70	609.60

Weights (unit: kg)

Nominal Pipe Size		Sch. 10S	Sch. 20	STD Sch. 40S	XS Sch. 80S
14	12	14.27	25.65	28.55	37.18
14	10	13.21	23.73	26.41	34.40
14	8	12.07	21.70	24.15	31.44
14	6	11.01	19.78	22.01	28.66
16	14	17.24	30.98	34.48	44.90
16	12	16.52	29.69	33.05	43.03
16	10	15.37	27.62	30.75	40.04
16	8	14.15	25.43	28.30	36.86
18	16	20.94	37.62	41.87	54.52
18	14	19.71	35.41	39.41	51.32
18	12	18.94	34.02	37.87	49.32
18	10	17.70	31.81	35.41	46.11
20	18	38.01	62.40	62.40	81.25
20	16	36.01	59.11	59.11	76.97
20	14	33.98	55.83	55.83	72.70
20	12	32.76	53.78	53.78	70.02
22	20	42.01	68.96	68.96	89.80
22	15	40.01	65.68	65.68	85.53
22	16	38.01	62.40	62.40	81.25
22	14	36.01	59.08	59.08	76.97
24	22	52.91	75.53	75.53	98.36
24	20	50.61	72.25	72.25	94.08
24	18	48.31	68.96	68.96	89.80
24	16	46.01	65.68	65.68	85.53
24	14	43.71	62.40	62.40	81.25
26	24		128.28	98.53	128.03
26	20		118.02	90.65	117.79
26	18		112.88	86.70	112.66
26	16		107.76	82.76	107.54
28	26		138.54	106.41	138.27
28	24		133.41	102.47	133.15
28	20		123.15	94.59	122.91
28	18		118.02	90.65	117.78
30	28		148.80	114.29	148.51
30	26		143.67	110.35	143.39
30	24		138.54	106.41	138.27
30	20		128.28	98.53	128.03
32	30		159.07	122.17	158.75
32	28		153.93	118.23	153.63

Note: Sch 40S and 80S apply up to 12" only



ASME/ASTM SA/A403 WPS (Seamless) ANSI B 16.9
ASME/ASTM SA/A403 WPW (Welded) ANSI B 16.9
ASME/ASTM SA/A403 WPWX (Welded/100% X Ray) ANSI B 16.9

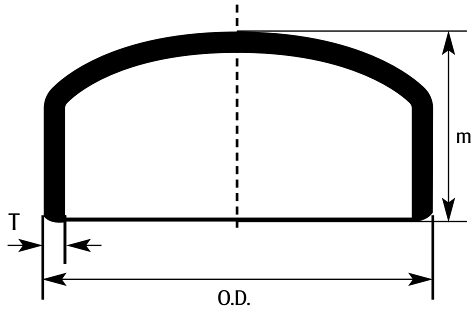
Dimensions (unit: mm)

Nominal Pipe Size		Out-Side Dia. OD_1	Out-Side Dia. OD_2	Wall Thickness (T_1, T_2) Sch. 10S T_1	Sch. 10S T_2	Sch. 20 T_1	Sch. 20 T_2	STD Sch. 40S T_1	STD Sch. 40S T_2	XS Sch. 80S T_1	XS Sch. 80S T_2	Length H
32	26	812.80	660.40			12.70	12.70	9.53	9.53	12.70	12.70	609.60
32	24	812.80	609.60			12.70	9.53	9.53	9.53	12.70	12.70	609.60
34	32	863.60	812.80			12.70	12.70	9.53	9.53	12.70	12.70	609.60
34	30	863.60	762.00			12.70	12.70	9.53	9.53	12.70	12.70	609.60
34	28	863.60	711.20			12.70	12.70	9.53	9.53	12.70	12.70	609.60
34	26	863.60	660.40			12.70	12.70	9.53	9.53	12.70	12.70	609.60
36	34	914.40	863.60			12.70	12.70	9.53	9.53	12.70	12.70	609.60
36	32	914.40	812.80			12.70	12.70	9.53	9.53	12.70	12.70	609.60
36	30	914.40	762.00			12.70	12.70	9.53	9.53	12.70	12.70	609.60
36	28	914.40	711.20			12.70	12.70	9.53	9.53	12.70	12.70	609.60
38	36	965.20	914.40					9.53	9.53	12.70	12.70	609.60
38	34	965.20	863.60					9.53	9.53	12.70	12.70	609.60
38	32	965.20	812.80					9.53	9.53	12.70	12.70	609.60
38	30	965.20	762.00					9.53	9.53	12.70	12.70	609.60
38	28	965.20	711.20					9.53	9.53	12.70	12.70	609.60
38	26	965.20	660.40					9.53	9.53	12.70	12.70	609.60
40	38	1016.00	965.20					9.53	9.53	12.70	12.70	609.60
40	36	1016.00	914.40					9.53	9.53	12.70	12.70	609.60
40	34	1016.00	863.60					9.53	9.53	12.70	12.70	609.60
40	32	1016.00	812.80					9.53	9.53	12.70	12.70	609.60
40	30	1016.00	762.00					9.53	9.53	12.70	12.70	609.60
42	40	1066.80	1016.00					9.53	9.53	12.70	12.70	609.60
42	38	1066.80	965.20					9.53	9.53	12.70	12.70	609.60
42	36	1066.80	914.40					9.53	9.53	12.70	12.70	609.60
42	34	1066.80	863.60					9.53	9.53	12.70	12.70	609.60
42	32	1066.80	812.80					9.53	9.53	12.70	12.70	609.60
42	30	1066.80	762.00					9.53	9.53	12.70	12.70	609.60
44	42	1117.60	1066.80					9.53	9.53	12.70	12.70	609.60
44	40	1117.60	1016.00					9.53	9.53	12.70	12.70	609.60
44	38	1117.60	965.20					9.53	9.53	12.70	12.70	609.60
44	36	1117.60	914.40					9.53	9.53	12.70	12.70	609.60
46	44	1168.40	1117.60					9.53	9.53	12.70	12.70	711.20
46	42	1168.40	1066.80					9.53	9.53	12.70	12.70	711.20
46	40	1168.40	1016.00					9.53	9.53	12.70	12.70	711.20
46	38	1168.40	965.20					9.53	9.53	12.70	12.70	711.20
46	36	1168.40	914.40					9.53	9.53	12.70	12.70	711.20
48	44	1219.20	1117.60					9.53	9.53	12.70	12.70	711.20
48	42	1219.20	1066.80					9.53	9.53	12.70	12.70	711.20
48	40	1219.20	1016.00					9.53	9.53	12.70	12.70	711.20

Weights (unit: kg)

Nominal Pipe Size		Sch. 10S	Sch. 20	STD Sch. 40S	XS Sch. 80S
32	26		148.80	114.29	148.51
32	24		143.67	110.40	143.39
34	32		169.33	130.06	168.99
34	30		164.20	126.12	163.88
34	28		159.07	122.17	158.75
34	26		153.93	118.51	153.63
36	34		179.59	137.94	179.24
36	32		174.46	133.99	174.12
36	30		169.33	130.06	168.99
36	28		164.20	126.12	163.88
38	36			145.82	189.48
38	34			141.88	184.36
38	32			137.94	179.24
38	30			133.99	174.12
38	28			130.06	168.99
38	26			126.12	163.88
40	38			153.70	199.72
40	36			149.76	194.60
40	34			145.82	189.46
40	32			141.88	184.36
40	30			137.94	179.24
42	40			161.59	209.97
42	38			157.64	204.85
42	36			153.70	199.72
42	34			149.76	194.60
42	32			145.82	189.48
42	30			141.88	184.36
44	42			169.47	220.21
44	40			165.53	215.09
44	38			161.59	209.97
44	36			157.64	204.85
46	44			177.35	230.45
46	42			173.41	225.33
46	40			169.47	220.21
46	38			165.53	215.09
46	36			165.53	215.09
48	44			181.29	235.57
48	42			177.35	230.45
48	40			173.41	225.33

Note: Sch 40S and 80S apply up to 12" only



ASME/ASTM SA/A403 WPS (Seamless) ANSI B 16-9.

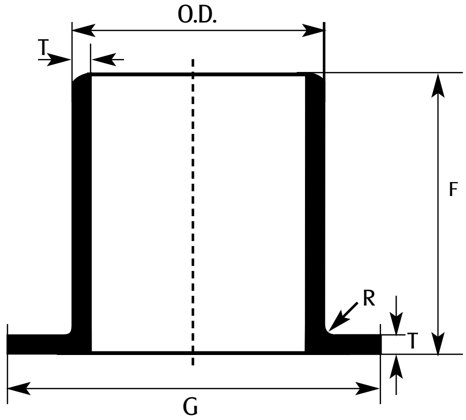
Dimensions (unit: mm)

Nominal Pipe Size	Outside Dia. (OD)	Wall Thickness (T)				Centre to End E
		Sch.5S	Sch.10S	STD Sch.40S	XS Sch.80S	
1/2	21.34	1.65	2.11	2.77	3.73	25.40
3/4	26.67	1.65	2.11	2.87	3.91	25.40
1	33.40	1.65	2.77	3.38	4.55	38.10
1 1/4	42.16	1.65	2.77	3.56	4.85	38.10
1 1/2	48.26	1.65	2.77	3.68	5.08	38.10
2	60.32	1.65	2.77	3.91	5.54	38.10
2 1/2	73.02	2.11	3.05	5.16	7.01	50.80
3	88.90	2.11	3.05	5.49	7.62	63.50
4	114.30	2.11	3.05	6.02	8.56	76.20
5	141.30	2.77	3.40	6.55	9.53	88.90
6	168.27	2.77	3.40	7.11	10.97	101.60
8	219.08	2.77	3.76	8.18	12.70	127.00
10	273.00	3.40	4.19	9.53	12.70	152.40
12	323.85	3.96	4.57	9.53	12.70	177.80
14	355.60		4.78	9.53	12.70	190.50
16	406.40		4.78	9.53	12.70	203.20
18	457.20		4.78	9.53	12.70	228.60
20	508.00		5.54	9.53	12.70	254.00
24	609.60		6.35	9.53	12.70	304.80

Note: Sch 40S and 80S apply up to 12" only

Weights (unit: kg)

Nominal Pipe Size	Sch.5S	Sch.10S	STD Sch.40S	XS Sch.80S
1/2	0.036	0.040	0.046	0.045
3/4	0.049	0.052	0.059	0.086
1	0.053	0.090	0.109	0.109
1 1/4	0.066	0.113	0.145	0.159
1 1/2	0.076	0.130	0.171	0.222
2	0.099	0.168	0.234	0.344
2 1/2	0.169	0.242	0.420	0.512
3	0.253	0.362	0.664	0.888
4	0.409	0.585	1.17	1.51
5	0.805	0.978	1.90	2.89
6	1.11	1.35	2.83	4.24
8	1.74	2.49	5.11	7.76
10	3.26	3.84	8.92	13.11
12	5.47	6.15	14.10	17.94
14	7.19	7.85	16.35	21.11
16	10.99	9.56	18.60	25.73
18	13.92	12.10	23.54	32.57
20	17.19	17.90	29.06	40.21
24	27.43	30.15	41.85	57.86



ASME/ASTM SA/A403 WPS (Seamless) ANSI B 16-9
ASME/ASTM SA/A403 WPW (Welded) ANSI B 16-9
ASME/ASTM SA/A403 WPWX (Welded/100% X Ray) ANSI B 16-9

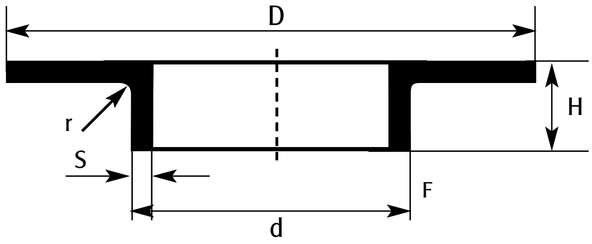
Dimensions (unit: mm)

Nom. Pipe Size	Out-Side Dia. (OD)	Wall Thickness (T) Sch.5S	Sch 10S	STD Sch.40S	XS Sch.80S	Dia. of Lap (G)	Length F ANSI	MSS	Radius R Type A (Max)	Type B (Max)
1/2	21.34	1.65	2.11	2.77	3.73	34.93	76.20	50.80	3.30	0.76
3/4	26.67	1.65	2.11	2.87	3.91	42.88	76.20	50.80	3.30	0.76
1	33.40	1.65	2.77	3.38	4.55	50.80	101.60	50.80	3.30	0.76
1 1/4	42.16	1.65	2.77	3.56	4.85	63.50	101.60	50.80	4.83	0.76
1 1/2	48.26	1.65	2.77	3.68	5.08	73.02	101.60	50.80	6.35	0.76
2	60.32	1.65	2.77	3.91	5.54	92.07	152.40	63.50	7.87	0.76
2 1/2	73.02	2.11	3.05	5.16	7.01	104.77	152.40	63.50	7.87	0.76
3	88.90	2.11	3.05	5.49	7.62	127.00	152.40	63.50	9.65	0.76
4	114.30	2.11	3.05	6.02	8.56	157.18	152.40	76.20	11.18	0.76
5	141.30	2.77	3.40	6.55	9.53	185.75	203.20	76.20	11.18	1.52
6	168.27	2.77	3.40	7.11	10.97	215.90	203.20	88.90	12.70	1.52
8	219.08	2.77	3.76	8.18	12.70	269.88	203.20	101.60	12.70	1.52
10	273.05	3.40	4.19	9.27	12.70	323.85	254.00	127.00	12.70	1.52
12	323.85	3.96	4.57	9.53	12.70	381.00	254.00	152.40	12.70	1.52
14	355.60	3.96	4.78	9.53	12.70	412.75	304.80	152.40	12.70	1.52
16	406.40	4.19	4.78	9.53	12.70	469.90	304.80	152.40	12.70	1.52
18	457.20	4.19	4.78	9.53	12.70	533.40	304.80	152.40	12.70	1.52
20	508.00	4.78	5.54	9.53	12.70	584.20	304.80	152.40	12.70	1.52
22	558.80	4.78	5.54	9.53	12.70	641.35	304.80	-	12.70	1.52
24	609.60	5.54	6.35	9.53	12.70	692.15	304.80	152.40	12.70	1.52

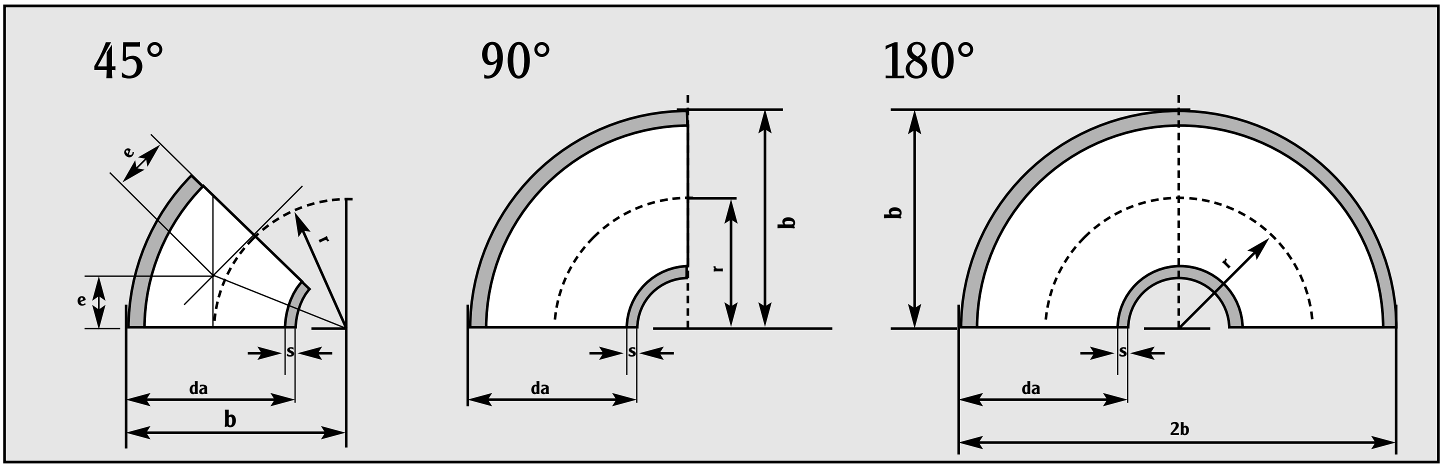
Note: Sch 40S and 80S apply up to 12" only

Weights (unit: kg)

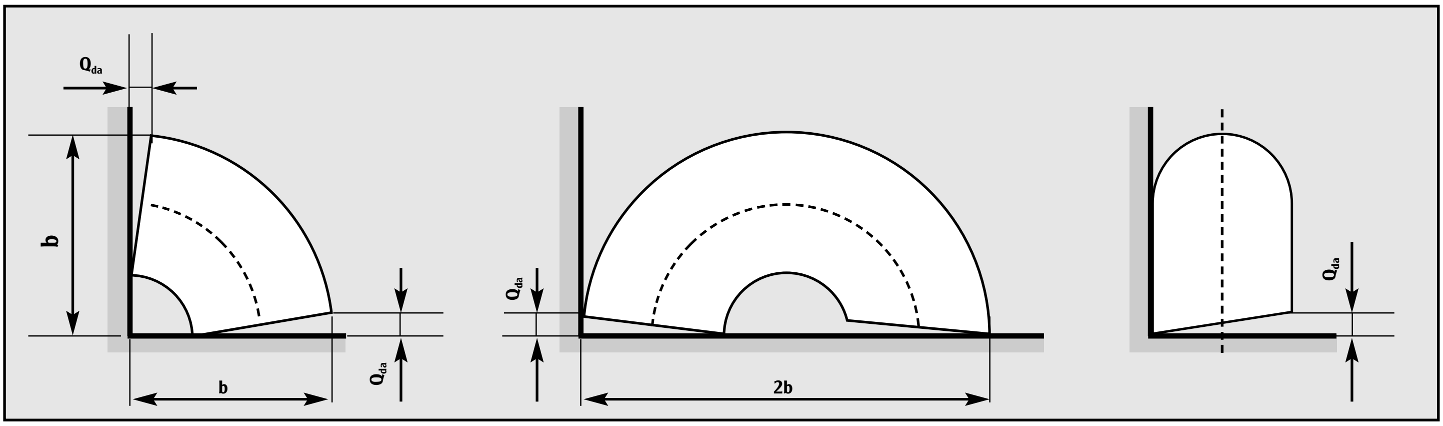
Nominal Pipe Size	F	Sch. 5S	Sch. 10S	STD Sch. 40S	XS Sch. 80S
1/2	MSS	0.059	0.077	0.118	0.127
3/4	MSS	0.068	0.086	0.154	0.168
1	MSS	0.091	0.140	0.186	0.240
1 1/4	MSS	0.131	0.208	0.263	0.349
1 1/2	MSS	0.159	0.249	0.376	0.458
2	MSS	0.245	0.376	0.539	0.743
2 1/2	MSS	0.349	0.471	0.797	1.060
3	MSS	0.467	0.638	1.133	1.508
4	MSS	0.711	0.978	1.812	2.523
5	MSS	1.046	1.237	2.537	3.601
6	MSS	1.62	1.95	3.72	5.57
8	MSS	2.45	3.10	5.89	10.12
10	MSS	4.04	4.86	10.42	13.95
12	MSS	6.60	7.11	14.95	19.93
14	MSS	6.43	7.75	15.46	20.62
16	MSS	7.91	9.02	17.98	23.98
18	MSS	9.24	10.53	21.00	28.00
20	MSS	11.68	13.54	23.30	31.07
22	MSS				
24	MSS	16.52	18.94	28.41	37.88



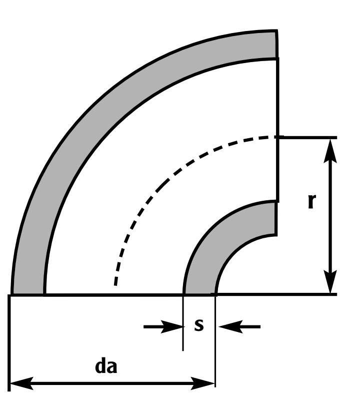
Nominal diameter	Diameter in inches	d	D	r	H	s
10	3/8"	17.2	40	3	9	As per ANSI B36-10/B36-19 or customer specification
15	1/2"	21.3	45	3	9	
20	1/2"	26.9	58	3	12	
25	1"	33.7	68	4	15	
32	1 1/4"	42.4	78	4	15	
40	1 1/2"	48.3	88	4	17	
50	2"	60.3	102	5	23	
65	2 1/2"	73	122	5	23	
80	3"	88.9	138	5	23	
100	4"	114.3	158	5	28	
125	5"	141.3	188	5	30	
150	6"	168.3	212	5	30	
200	8"	219.1	268	5	30	
250	10"	273.2	320	5	30	
300	12"	323.9	370	6	35	
350	14"	355.6	430	6	-	
400	16"	406.4	482	6	-	
450	18"	457.2	532	6	-	
500	20"	508	585	6	-	
600	24"	609.6	685	7	-	
700	28"	711.2	800	7	-	
800	32"	812.8	905	7	-	
900	36"	914.4	1005	7	-	
1000	40"	1016	1110	8	-	
1200	48"	1219.2	1330	8	-	



Tolerances



Outside Ø da mm			Standard da	Standard Q	b 45° mm	b 90° mm	2b 180° mm	Wall thickness S	Ovality Welding edge	Ovality body	di	Special Requirements da	Special Requirements Q
21,3	-	76,1	± 1%	1%	± 6	± 2,5	± 8,0	Smin	perm.	4%	di min:	± 0,4 mm	0,5%
	-	114,3	min.	v. da	± 7	± 7	± 9,0	(Body):	da	4%	0,8 x	± 0,4 mm	v. da
	-	219,1	0,5 mm	min.	± 8,5	± 3,5	± 10,0	- 12,5%	tolerance	4%	di-Tube	± 0,5%	min.
	-	273		1,0 mm	± 9,5	± 4,0	± 14,0		2%	4%	theor. di	± 0,6%	0,5 mm
	-	457			± 12,0	± 5,0	± 14,0	Smax	2%	4%		± 0,6%	
	-	610			± 14,5	± 6,0	± 16,0	(Welding	2%	4%		± 0,6%	
	-	711			± 14,5	± 6,0		edge)	2%	4%		± 0,6%	
	-	1016			± 19,0	± 8,0		+ 15%	2%	4%		± 0,6%	



Dimensions (unit: mm)

Outside Ø da mm	Radius r mm	Wall Thickn. s mm	Weight/kg Design		
			2	3	5
21.3		2	0.03	0.04	0.06
	2: 17.5 ± 2.5	2.3	0.03	0.05	0.07
	3: 28 ± 2.5	2.6	0.03	0.05	0.08
	5: 42.5 ± 2.5	3.2	0.04	0.06	0.10
26.9		2.3	0.05	0.06	0.13
	2: 25 ± 2.5	2.9	0.06	0.08	0.16
	3: 29 ± 2.5	3.2	0.07	0.08	0.17
	5: 57.5 ± 2.5	4	0.09	0.10	0.20
31.8		2.6	0.08	0.10	0.20
	2: 27.5 ± 2.5	2.9	0.09	0.11	0.22
	3: 35 ± 2.5	3.2	0.10	0.12	0.24
	5: 67.5 ± 2.5	3.6	0.11	0.14	0.27
33.7		2.6	0.09	0.12	0.23
	2: 25 ± 2.5	3.2	0.11	0.14	0.27
	3: 38 ± 2.5	3.6	0.13	0.16	0.30
	5: 72.5 ± 2.5	4	0.14	0.17	0.33
38		2.6	0.13	0.16	0.29
	2: 32.5 ± 2.5	2.9	0.13	0.18	0.33
	3: 45 ± 2.5	3.2	0.14	0.19	0.36
	5: 82.5 ± 2.5	3.6	0.16	0.22	0.40
42.4		2.6	0.15	0.19	0.37
	2: 32 ± 2.5	3.6	0.20	0.26	0.50
	3: 48 ± 2.5	4	0.22	0.28	0.55
	5: 92.5 ± 2.5	4.5	0.25	0.31	0.61
		5	0.27	0.34	0.67
44.5		2.6	0.17	0.22	0.41
	2:40 ± 2.5	2.9	0.19	0.24	0.46
	3: 51 ± 2.5	3.2	0.20	0.26	0.50
	5: 97.5 ± 2.5	3.6	0.23	0.29	0.56
48.3		2.6	0.20	0.26	0.49
	2: 38 ± 3	3.2	0.24	0.32	0.60
	3: 57 ± 3	3.6	0.26	0.36	0.67
	5: 107.5 ± 3	4	0.29	0.39	0.74
		4.5	0.32	0.44	0.82
		5	0.36	0.48	0.90

Weights (unit: kg)

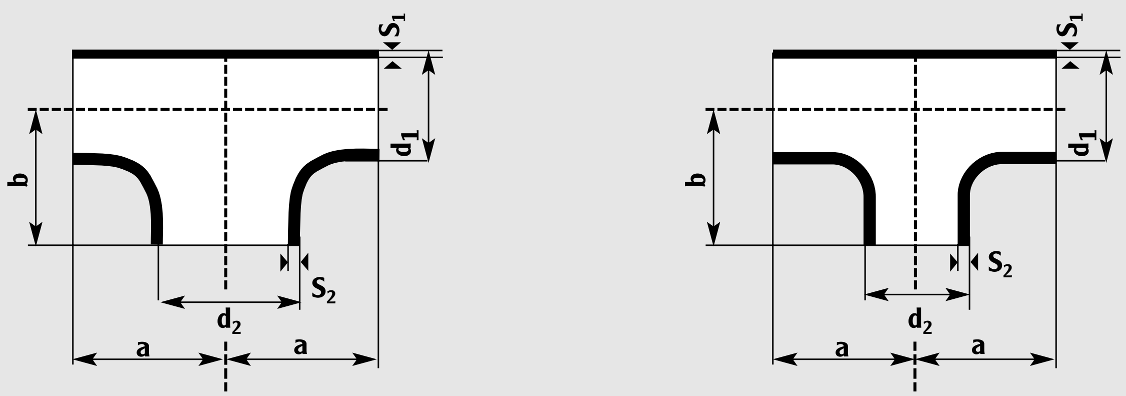
Outside Ø da mm	Radius r mm	Wall Thickn. s mm	Weight/kg Design		
			2	3	5
57		2.9	0.33	0.44	0.77
	2: 52.5 ± 3	3.2	0.35	0.48	0.85
	3: 72.0 ± 3	3.6	0.39	0.54	0.95
	5: 127.5 ± 3	4	0.43	0.59	1.05
60.3		2.9	0.35	0.49	0.87
	2: 51 ± 3	3.2	0.39	0.54	0.96
	3: 76 ± 3	3.6	0.43	0.60	1.07
	5: 135 ± 3	4	0.48	0.66	1.18
		4.5	0.53	0.74	1.31
		5	0.59	0.81	1.45
		5.6	0.65	0.90	1.60
		6.3	0.72	1.00	1.78
63.5		2.9	0.39	0.56	0.97
	2: 57.5 ± 3	3.2	0.43	0.62	1.07
	3: 82.5 ± 3	3.6	0.48	0.69	1.19
	5: 142.5 ± 3	4	0.53	0.76	1.31
70		2.9	0.49	0.69	1.21
	2: 65 ± 3	3.2	0.54	0.76	1.32
	3: 92 ± 3	3.6	0.60	0.85	1.48
	5: 160 ± 3	4	0.66	0.94	1.64
76.1		2.9	0.58	0.78	1.44
	2: 63 ± 3	3.6	0.71	0.96	1.77
	3: 95 ± 3	4	0.78	1.06	1.96
	5: 175 ± 3	4.5	0.87	1.19	2.18
		5	0.96	1.31	2.41
		5.6	1.07	1.45	2.68
		6.3	1.19	1.62	2.98
		7.1	1.33	1.80	3.32
88.9		3.2	0.88	1.22	2.18
	2: 76 ± 3	4	1.09	1.51	2.70
	3: 114 ± 3	4.5	1.21	1.68	3.02
	5: 205 ± 3	5	1.34	1.86	3.33
		5.6	1.49	2.07	3.70
		6.3	1.66	2.31	4.13
		8	2.07	2.87	5.14
108		3.6	1.46	2.07	3.68
	2: 100 ± 3	4	1.61	2.30	4.07
	3: 142.5 ± 3	4.5	1.80	2.57	4.56
	5: 252.5 ± 3	5	2.00	2.84	5.04

Dimensions (unit: mm)

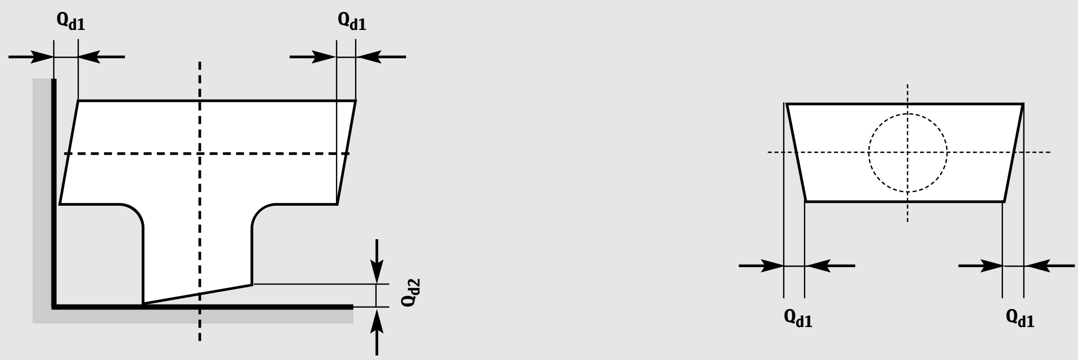
Outside Ø da mm	Radius r mm	Wall Thickn. s mm	Weight/kg Design 2	3	5
114.3		3.6	1.62	2.35	4.17
	2: 102 ± 3	4	1.79	2.61	4.61
	3: 152 ± 3	4.5	2.01	2.92	5.17
	5: 270 ± 3	5.6	2.48	3.60	6.37
		6.3	2.77	4.02	7.12
		7.1	3.10	4.50	7.96
		8.8	3.78	5.48	9.71
133		4	2.50	3.62	6.25
	2: 125 ± 4	4.5	2.80	4.05	7.00
	3: 181 ± 4	5	3.10	4.49	7.75
	5: 312.5 ± 4	6.3	3.87	5.60	9.66
139.7		4	2.79	4.01	6.94
	2: 127 ± 4	4.5	3.12	4.49	7.78
	3: 190 ± 4	5	3.46	4.97	8.61
	5: 330 ± 4	6.3	4.31	6.20	10.7
		7.1	4.83	6.95	12.0
		8	5.41	7.78	13.5
		10	6.66	9.57	16.6
159		4.5	4.04	5.82	10.1
	2: 150 ± 4	5	4.47	6.44	11.2
	3: 216 ± 4	5.6	4.99	7.19	12.5
	5: 375 ± 4	6.3	5.59	8.05	14.0
168.3		4.5	4.43	6.52	11.1
	2: 152 ± 4	5.6	5.47	8.06	13.8
	3: 229 ± 4	6.3	6.13	9.03	15.4
	5: 390 ± 4	7.1	6.87	10.1	17.3
		8	7.70	11.4	19.4
		11	10.4	15.3	26.1
193.7		5.4	7.09	10.6	17.9
	2: 180 ± 4	5.6	7.35	11.0	18.6
	3: 270 ± 4	6.3	8.23	12.4	20.8
	5: 455 ± 4	7.1	9.24	13.9	23.4
219.1		6.3	10.9	15.8	26.5
	2: 203 ± 4	8	13.7	20.0	33.4
	3: 305 ± 4	8.8	15.1	21.9	36.6
	5: 510 ± 4	10	17.0	24.7	41.3
		12.5	21.0	30.5	51.0
273		6.3	16.5	24.8	42.3
	2: 254 ± 5	7.1	18.6	27.9	47.5
	3: 381 ± 5	8.8	22.9	34.3	58.4
	5: 650 ± 5	10	25.9	38.8	66.2
		12.5	32.0	48.1	82.0

Weights (unit: kg)

Outside Ø da mm	Radius r mm	Wall Thickn. s mm	Weight/kg Design 2	3	5
323.9		7.1	26.6	39.8	67.5
	2: 305 ± 5	8	29.9	44.7	75.9
	3: 457 ± 5	10	37.1	55.6	94.2
	5: 775 ± 5	12.5	46.0	68.9	117
355.6		8	38.2	57.5	91.6
	2: 356 ± 10	47.5	71.4	114	
	3: 533 ± 10	11	52.1	78.3	125
	5: 850 ± 10	12.5	59.0	88.6	141
406.4		8.8	55.1	82.6	131
	2: 406 ± 10	10	62.4	93.6	149
	3: 610 ± 10	12.5	77.5	116	185
	5: 970 ± 10	14.2	87.7	131	209
457.2	10	78.8	119	194	
	2: 457 ± 15	11	86.5	130	213
	3: 686 ± 15	12.5	98.0	148	242
	5: 1122 ± 15	14.2	111	167	274
508		11	107	161	264
	2: 508 ± 25	12.5	121	183	299
	3: 762 ± 25	14.2	137	207	338
	5: 1245 ± 25	16	154	232	380
609.6		12.5	176	264	434
	2: 610 ± 25	14.2	200	299	491
	3: 914 ± 25	16	224	336	552
	5: 1525 ± 25	17.5	245	367	602
711.2		12.5	237	355	592
	2: 711 ± 30	14.2	268	403	671
	3: 1067 ± 30	16	302	452	754
	5: 1778 ± 30	17.5	329	494	823
812.8		12.5	314	465	775
	2: 813 ± 35	14.2	356	527	879
	3: 1219 ± 35	16	400	593	988
	5: 2033 ± 35	17.5	437	647	1078
914.4		14.2	451	678	1114
	2: 914 ± 40	16	507	763	1253
	3: 1372 ± 40	17.5	555	833	1389
	5: 2285 ± 40	20	632	949	1583



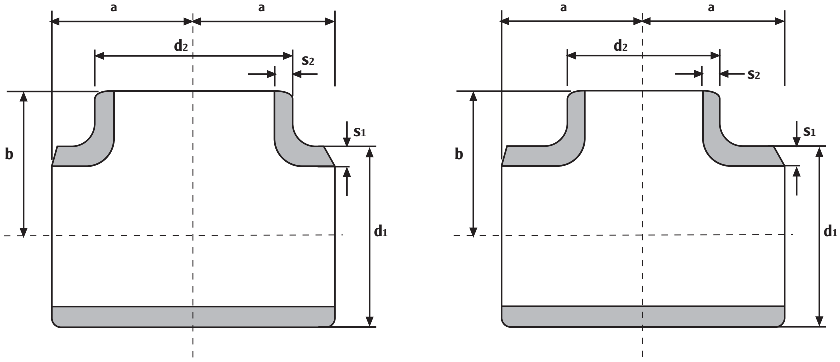
Tolerances



Outside Ø da mm	Standard d_{1+2}	Q	a, b mm		Wall thickness S_{1+2}	Ovality Welding edge	Ovality body	di	Special Requirements d_{1+2}	Q
21.3 - 76.1	± 1%	1%	± 2.0		Smin	perm.	4%	di min:	± 0.4 mm	0.5%
- 114.3	min.	v. da	± 2.0		(Body):	da	4%	0.8 x	± 0.4 mm	v. da
- 219.1	0.5 mm	min.	± 2.0		- 12.5%	tolerance	4%	di-Tube	± 0.5%	min.
- 273		1.0 mm	± 3.0			2%	4%	(theor. di)	± 0.6%	0.5 mm
- 323.9			± 3.0		Smax	2%	4%		± 0.6%	
					(Welding					
					edge):					
					+ 15%					

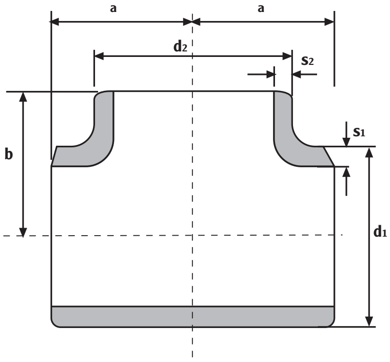
d1+2 = Outside Diameter on welding edge
S1+2 = Wall thickness on welding edge

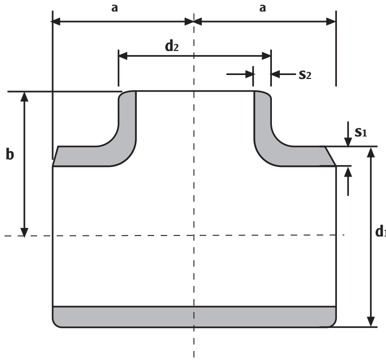
Standard Execution
Bevel to DIN 2559, Shape 22 up to 3,2 mm



Run Size Outside Ø d1 mm	Run Size Wall thickn. s1 mm	Branch Outside Ø d2 mm	Branch Wall thickness s2 mm	a mm	b mm	Weight approx. kg
21.3	2.0	21.3	2.0	25	25	0.09
		17.2	1.8	25	25	0.09
	3.2	21.3	3.2	25	25	0.15
		17.2	2.9	25	25	0.15
	4.0	21.3	4.0	25	25	0.18
26.9	2.3	26.9	2.3	29	29	0.15
		21.3	2.0	29	29	0.15
		17.2	1.8	29	29	0.15
	3.2	26.9	3.2	29	29	0.21
		21.3	3.2	29	29	0.21
	4.0	26.9	4.0	29	29	0.25
		21.3	4.0	29	29	0.25
33.7	2.6	33.7	2.6	38	38	0.29
		26.9	2.3	38	38	0.29
		21.3	2.0	38	38	0.29
	3.2	33.7	3.2	38	38	0.35
		26.9	3.2	38	38	0.35
		21.3	3.2	38	38	0.35
	4.0	33.7	4.0	38	38	0.42
		26.9	4.0	38	38	0.42
		21.3	4.0	38	38	0.42

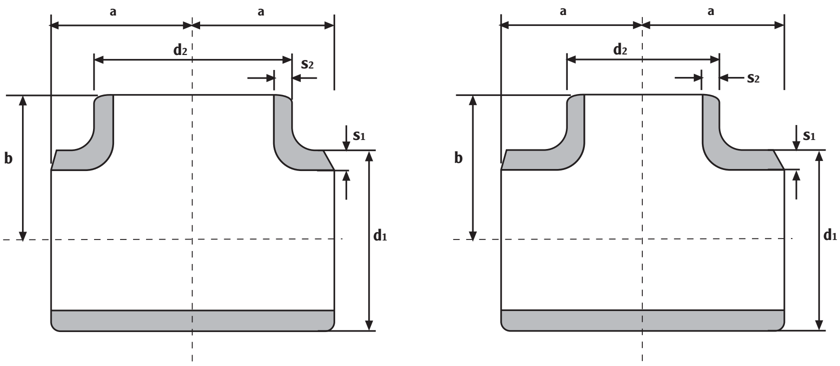
Run Size Outside Ø d1 mm	Run Size Wall thickn. s1 mm	Branch Outside Ø d2 mm	Branch Wall thickness s2 mm	a mm	b mm	Weight approx. kg
42.4	2.6	42.4	2.6	48	48	0.42
		33.7	2.6	48	48	0.42
		26.9	2.3	48	48	0.42
	3.6	42.4	3.6	48	48	0.57
		33.7	3.2	48	48	0.57
		26.9	3.2	48	48	0.57
	4.0	42.4	4.0	48	48	0.63
		33.7	4.0	48	48	0.63
		26.9	4.0	48	48	0.63
48.3	2.6	48.3	2.6	57	57	0.59
		42.4	2.6	57	57	0.59
		33.7	2.6	57	57	0.59
		26.9	2.3	57	57	0.59
	4.0	48.3	4.0	57	57	0.90
		42.4	3.6	57	57	0.90
		33.7	3.2	57	57	0.90
		26.9	3.2	57	57	0.90
	5.0	48.3	5.0	57	57	1.10
		42.4	4.0	57	57	1.10
		33.7	4.0	57	57	1.10
		26.9	4.0	57	57	1.10





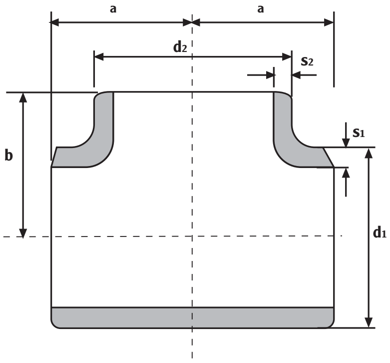
Run Size		Branch				Weight
Outside Ø d1 mm	Wall thickn. s1 mm	Outside Ø d2 mm	Wall thickness s2 mm	a mm	b mm	approx. kg
57.0	2.9	57.0	2.9	60	60	0.85
60.3	2.9	60.3	2.9	64	64	0.90
		48.3	2.6	64	60	0.90
		42.4	2.6	64	57	0.90
		33.7	2.6	64	51	0.90
	4.5	60.3	4.5	64	64	1.35
		48.3	4.0	64	60	1.35
		42.4	3.6	64	57	1.35
		33.7	3.2	64	51	1.35
	5.6	60.3	5.6	64	64	1.65
		48.3	5.0	64	60	1.65
		42.4	4.0	64	57	1.65
		33.7	4.0	64	51	1.65
76.1	2.9	76.1	2.9	76	76	1.35
		60.3	2.9	76	70	1.35
		48.3	2.6	76	67	1.35
		42.4	2.6	76	64	1.35
	5.0	76.1	5.0	76	76	2.30
		60.3	4.5	76	70	2.30
		48.3	4.0	76	67	2.30
		42.4	3.6	76	64	2.3
	7.1	76.1	7.1	76	76	3.15
		60.3	5.6	76	70	3.15
		48.3	5.0	76	67	3.15
		42.4	4.0	76	64	3.15
88.9	3.2	88.9	3.2	86	86	1.95
		76.1	2.9	86	83	1.95
		60.3	2.9	86	76	1.95
		48.3	2.6	86	73	1.95
		42.4	2.6	86	70	1.95
	5.6	88.9	5.6	86	86	3.70
		76.1	5.0	86	83	3.70
		60.3	4.5	86	76	3.70
		48.3	4.0	86	73	3.70
		42.4	3.6	86	70	3.70
	8.0	88.9	8.0	86	86	4.60
		76.1	7.1	86	83	4.60
		60.3	5.6	86	76	4.60
		48.3	5.0	86	73	4.60
		42.4	4.0	86	70	4.60
108.0	3.6	108.0	3.6	100	100	3.15

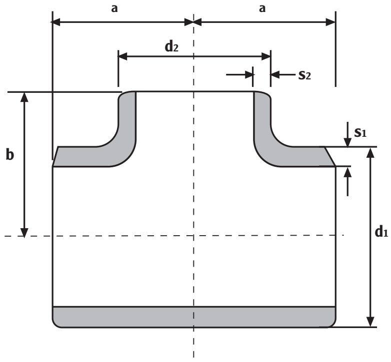
Run Size		Branch				Weight
Outside Ø d1 mm	Wall thickn. s1 mm	Outside Ø d2 mm	Wall thickness s2 mm	a mm	b mm	approx. kg
114.3	3.6	114.3	3.6	105	105	3.30
		88.9	3.2	105	98	3.30
		76.1	2.9	105	95	3.30
		60.3	2.9	105	89	3.30
	6.3	114.3	6.3	105	105	5.70
		88.9	5.6	105	98	5.70
		76.1	5.0	105	95	5.70
		60.3	4.5	105	89	5.70
	8.8	114.3	8.8	105	105	7.70
		88.9	8.0	105	98	7.70
		76.1	7.1	105	95	7.70
		60.3	5.6	105	89	7.70
133.0	4.0	133.0	4.0	120	120	4.60
139.7	4.0	139.7	4.0	124	124	5.10
		114.3	3.6	124	117	5.10
		88.9	3.2	124	111	5.10
		76.1	2.9	124	108	5.10
	6.3	139.7	6.3	124	124	7.90
		114.3	6.3	124	117	7.90
		88.9	5.6	124	111	7.90
		76.1	5.0	124	108	7.90
	10.0	139.7	10.0	124	124	12.0
		114.3	8.8	124	117	12.0
		88.9	8.0	124	111	12.0
		76.1	7.1	124	108	12.0
159.0	4.5	159.0	4.5	138	138	7.50
168.3	4.5	168.3	4.5	143	143	8.10
		139.7	4.0	143	137	8.10
		114.3	3.6	143	130	8.10
		88.9	3.2	143	124	8.10
	7.1	168.3	7.1	143	143	13.0
		139.7	6.3	143	137	13.0
		114.3	6.3	143	130	13.0
		88.9	5.6	143	124	13.0
	11.0	168.3	11.0	143	143	19.0
		139.7	10.0	143	137	19.0
		114.3	8.8	143	130	19.0
		88.9	8.0	143	124	19.0



Run Size		Branch				Weight
Outside Ø d1 mm	Wall thickn. s1 mm	Outside Ø d2 mm	Wall thickness s2 mm	a mm	b mm	approx. kg
219.1	6.3	219.1	6.3	178	178	18.0
		168.3	4.5	178	168	18.0
		139.7	4.0	178	162	18.0
		114.3	3.6	178	156	18.0
		88.9	3.2	178	152	18.0
	8.0	219.1	8.0	178	178	23.5
		168.3	7.1	178	168	23.5
		139.7	6.3	178	162	23.5
		114.3	6.3	178	156	23.5
		88.9	5.6	178	152	23.5
	12.5	219.1	12.5	178	178	35.5
		168.3	11.0	178	168	35.5
		139.7	10.0	178	162	35.5
		114.3	8.8	178	156	35.5
		88.9	8.0	178	152	35.5
267.0	6.3	267.0	6.3	210	210	25.5
273.0	6.3	273.0	6.3	216	216	26.5
		219.1	6.3	216	203	26.5
		168.3	4.5	216	194	26.5
		139.7	4.0	216	191	26.5
		114.3	3.6	216	184	26.5
	8.8	273.0	8.8	216	216	36.5
		219.1	8.0	216	203	36.5
		168.3	7.1	216	194	36.5
		139.7	6.3	216	191	36.5
		114.3	6.3	216	184	36.5
	14.2	273.0	14.2	216	216	58.0
		219.1	12.5	216	203	58.0
		168.3	11.0	216	194	58.0
		139.7	10.0	216	191	58.0
		114.3	8.8	216	184	58.0

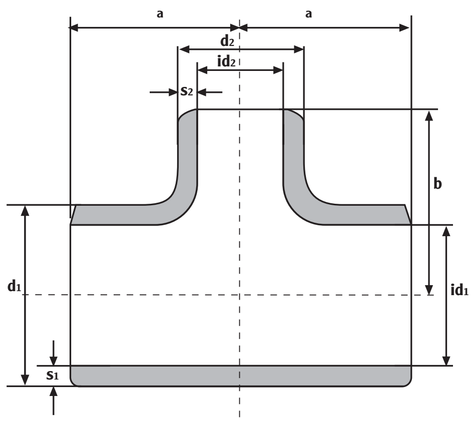
Run Size		Branch				Weight
Outside Ø d1 mm	Wall thickn. s1 mm	Outside Ø d2 mm	Wall thickness s2 mm	a mm	b mm	approx. kg
323.9	7.1	323.9	7.1	254	254	42.0
		273.0	6.3	254	241	42.0
		219.1	6.3	254	229	42.0
		168.3	4.5	254	219	42.0
		139.7	4.0	254	216	42.0
	10.0	323.9	10.0	254	254	59.0
		273.0	8.8	254	241	59.0
		219.1	8.0	254	229	59.0
		168.3	7.1	254	219	59.0
		139.7	6.3	254	216	59.0
	16.0	323.9	16.0	254	254	92.0
		273.0	14.2	254	241	92.0
		219.1	12.5	254	229	92.0
		168.3	11.0	254	219	92.0
		139.7	10.0	254	216	92.0
355.6	8.0	355.6	8.0	279	279	60.0
		323.9	7.1	279	270	60.0
		273.0	6.3	279	257	60.0
		219.1	6.3	279	248	54.0
		168.3	4.5	279	238	54.0
	11.0	355.6	11.0	279	279	86.0
		323.9	10.0	279	270	86.0
		273.0	8.8	279	257	86.0
		219.1	8.0	279	248	76.0
		168.3	7.1	279	238	76.0
	17.5	355.6	17.5	279	279	130.0
		323.9	16.0	279	270	130.0
		273.0	14.2	279	257	130.0
		219.1	12.5	279	248	116.0
		168.3	11.0	279	238	116.0





Run Size		Branch				Weight
Outside Ø d1 mm	Wall thickn. s1 mm	Outside Ø d2 mm	Wall thickness s2 mm	a mm	b mm	approx. kg
406.4	8.8	406.4	8.8	305	305	82.0
		355.6	8.0	305	305	82.0
		323.9	7.1	305	295	82.0
		273.0	6.3	305	283	82.0
		219.1	6.3	305	273	74.0
		168.3	4.5	305	264	74.0
	12.5	406.4	12.5	305	305	118.0
		355.6	11.0	305	305	118.0
		323.9	10.0	305	295	118.0
		273.0	8.8	305	283	118.0
		219.1	8.0	305	273	106.0
		168.3	7.1	305	264	106.0
	20.0	406.4	20.0	305	305	182.0
		355.6	17.5	305	305	182.0
		323.9	16.0	305	295	182.0
		273.0	14.2	305	283	182.0
		219.1	12.5	305	273	132.0
		168.3	11.0	305	264	132.0
457.0	10.0	457.0	10.0	343	343	131.0
		406.4	8.8	343	330	131.0
		355.6	8.0	343	330	131.0
		323.9	7.1	343	321	131.0
	14.2	457.0	14.2	343	343	183.0
		406.4	12.5	343	330	183.0
		355.6	11.0	343	330	183.0
		323.9	10.0	343	321	183.0
	22.2	457.0	22.2	343	343	268.0
		406.4	20.0	343	330	268.0
		355.6	17.5	343	330	226.0
		323.9	16.0	343	321	226.0
		273.0	14.2	343	308	226.0

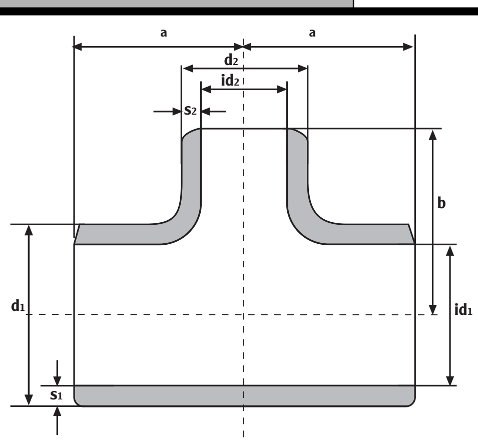
Run Size		Branch				Weight
Outside Ø d1 mm	Wall thickn. s1 mm	Outside Ø d2 mm	Wall thickness s2 mm	a mm	b mm	approx. kg
508.0	11.0	508.0	11.0	381	381	160.0
		457.0	10.0	381	368	160.0
		406.4	8.8	381	356	160.0
		355.6	8.0	381	356	160.0
		323.9	7.1	381	346	160.0
		273.0	6.3	381	333	160.0
	16.0	508.0	16.0	381	381	245.0
		457.0	14.2	381	368	245.0
		406.4	12.5	381	356	195.0
		355.6	11.0	381	356	195.0
		323.9	10.0	381	346	195.0
		273.0	8.8	381	333	195.0
	25.0	508.0	25.0	381	381	348.0
		457.0	22.2	381	368	348.0
		406.4	20.0	381	356	306.0
		355.6	17.5	381	356	306.0
		323.9	16.0	381	346	306.0
		273.0	14.2	381	333	306.0
610.0	12.5	610.0	12.5	432	432	242.0
		508.0	11.0	432	432	242.0
		457.0	10.0	432	419	242.0
		406.4	8.8	432	406	242.0
		355.6	8.0	432	406	242.0
		323.9	7.1	432	397	242.0
	17.5	610.0	17.5	432	432	333.0
		508.0	16.0	432	432	333.0
		457.0	14.2	432	419	333.0
		406.4	12.5	432	406	333.0
		355.6	11.0	432	406	333.0
		323.9	10.0	432	397	333.0
	30.0	610.0	30.0	432	432	470.0
		508.0	25.0	432	432	470.0
		457.0	22.2	432	419	470.0
		406.4	20.0	432	406	470.0
		355.6	17.5	432	406	470.0
		323.9	16.0	432	397	470.0
		273.0	14.2	432	384	470.0



s = seamless, w = welded

Size							Pieces		
d1	x	s1	d2	x	s2		kg	a	b
21.3	x	2.0	17.2	x	1.8	s	0.09	25	25
21.3	x	3.2	17.2	x	2.9	s	0.12	25	25
26.9	x	2.3	21.3	x	2.0	s	0.15	29	29
26.9	x	3.2	21.3	x	3.2	s	0.18	29	29
26.9	x	4.0	21.3	x	4.0	s	0.22	29	29
33.7	x	2.0	26.9	x	1.6	w*	0.20	38	38
33.7	x	2.0	21.3	x	1.6	w*	0.20	38	38
33.7	x	2.6	26.9	x	2.3	s	0.26	38	38
33.7	x	2.6	21.3	x	2.0	s	0.26	38	38
33.7	x	3.2	26.9	x	3.2	s	0.30	38	38
33.7	x	3.2	21.3	x	3.2	s	0.30	38	38
33.7	x	4.0	26.9	x	4.0	s	0.38	38	38
33.7	x	4.0	21.3	x	4.0	s	0.38	38	38
42.4	x	2.0	33.7	x	2.0	w	0.32	48	48
42.4	x	2.0	21.3	x	1.6	w*	0.32	48	48
42.4	x	2.6	33.7	x	2.6	s	0.42	48	48
42.4	x	2.6	26.9	x	2.3	s	0.42	48	48
42.4	x	3.6	33.7	x	3.2	s	0.57	48	48
42.4	x	3.6	26.9	x	3.2	s	0.57	48	48
42.4	x	4.0	33.7	x	4.0	s	0.64	48	48
42.4	x	4.0	26.9	x	4.0	s	0.64	48	48
48.3	x	2.0	42.4	x	2.0	w	0.46	57	57
48.3	x	2.0	33.7	x	2.0	w	0.46	57	57
48.3	x	2.6	42.4	x	2.6	s	0.59	57	57
48.3	x	2.6	33.7	x	2.6	s	0.59	57	57
48.3	x	2.6	26.9	x	2.3	s	0.59	57	57
48.3	x	4.0	42.4	x	3.6	s	0.85	57	57
48.3	x	4.0	33.7	x	3.2	s	0.85	57	57
48.3	x	4.0	26.9	x	3.2	s	0.85	57	57
48.3	x	5.0	42.4	x	4.0	s	1.05	57	57
48.3	x	5.0	33.7	x	4.0	s	1.05	57	57
48.3	x	5.0	26.9	x	4.0	s	1.05	57	57
60.3	x	2.0	48.3	x	2.0	w	0.57	64	60
60.3	x	2.0	42.4	x	2.0	w	0.54	64	57
60.3	x	2.0	33.7	x	2.0	w	0.50	64	51
60.3	x	2.0	26.9	x	1.6	w*	0.50	64	44
60.3	x	2.0	21.3	x	1.6	w*	0.48	64	42
60.3	x	2.9	48.3	x	2.6	s	0.79	64	60
60.3	x	2.9	42.4	x	2.6	s	0.76	64	57
60.3	x	2.9	33.7	x	2.6	s	0.72	64	51
60.3	x	2.9	26.9	x	2.3	s	0.72	64	44
60.3	x	2.9	21.3	x	2.0	s	0.72	64	42
60.3	x	4.0	48.3	x	4.0	s	1.25	64	60
60.3	x	4.0	42.4	x	3.6	s	1.20	64	57
60.3	x	4.0	33.7	x	3.2	s	1.20	64	51
60.3	x	4.5	48.3	x	4.0	s	1.40	64	60

Size							Pieces		
d1	x	s1	d2	x	s2		kg	a	b
60.3	x	4.5	42.4	x	3.6	s	1.35	64	57
60.3	x	4.5	33.7	x	3.2	s	1.35	64	51
76.1	x	2.3	60.3	x	2.0	w	1.00	76	70
76.1	x	2.3	48.3	x	2.0	w	0.95	76	67
76.1	x	2.3	42.4	x	2.0	w	0.95	76	64
76.1	x	2.3	33.7	x	2.0	w	0.90	76	57
76.1	x	2.9	60.3	x	2.9	s	1.25	76	70
76.1	x	2.9	48.3	x	2.6	s	1.16	76	67
76.1	x	2.9	42.4	x	2.6	s	1.12	76	64
76.1	x	5.0	60.3	x	4.5	s	1.90	76	70
76.1	x	5.0	60.3	x	4.0	s	1.80	76	70
76.1	x	5.0	48.3	x	4.0	s	1.85	76	67
76.1	x	5.0	42.4	x	3.6	s	1.85	76	64
76.1	x	7.1	60.3	x	5.6	s	2.70	76	70
76.1	x	7.1	48.3	x	5.0	s	2.65	76	67
76.1	x	7.1	42.4	x	4.0	s	2.65	76	64
88.9	x	2.3	76.1	x	2.3	w	1.40	86	83
88.9	x	2.3	60.3	x	2.0	w	1.35	86	76
88.9	x	2.3	48.3	x	2.0	w	1.30	86	73
88.9	x	2.3	42.4	x	2.0	w	1.30	86	70
88.9	x	3.2	76.1	x	2.9	s	1.85	86	83
88.9	x	3.2	60.3	x	2.9	s	1.80	86	76
88.9	x	3.2	48.3	x	2.6	s	1.70	86	73
88.9	x	5.6	76.1	x	5.0	s	3.10	86	83
88.9	x	5.6	60.3	x	4.5	s	2.90	86	76
88.9	x	5.6	60.3	x	4.0	s	2.85	86	76
88.9	x	5.6	48.3	x	4.0	s	2.80	86	73
88.9	x	8.0	76.1	x	7.1	s	4.20	86	83
88.9	x	8.0	60.3	x	5.6	s	4.00	86	76
88.9	x	8.0	48.3	x	5.0	s	4.00	86	73
114.3	x	2.6	88.9	x	2.3	w	2.25	105	98
114.3	x	2.6	76.1	x	2.3	w	2.15	105	95
114.3	x	2.6	60.3	x	2.0	w	2.15	105	89
114.3	x	2.6	48.3	x	2.0	w	2.15	105	86
114.3	x	2.6	42.4	x	2.0	w	2.15	105	84
114.3	x	3.6	88.9	x	3.2	s	3.00	105	98
114.3	x	3.6	76.1	x	3.6	s	2.90	105	95
114.3	x	3.6	60.3	x	2.9	s	2.90	105	89
114.3	x	6.3	88.9	x	5.6	s	5.10	105	98
114.3	x	6.3	76.1	x	5.0	s	5.00	105	95
114.3	x	6.3	60.3	x	4.5	s	4.85	105	89
114.3	x	6.3	60.3	x	4.0	s	4.80	105	89
139.7	x	2.6	114.3	x	2.6	w	3.30	124	117
139.7	x	2.6	88.9	x	2.3	w	3.10	124	111
139.7	x	2.6	76.1	x	2.3	w	3.10	124	108
139.7	x	2.6	60.3	x	2.0	w	3.00	124	105

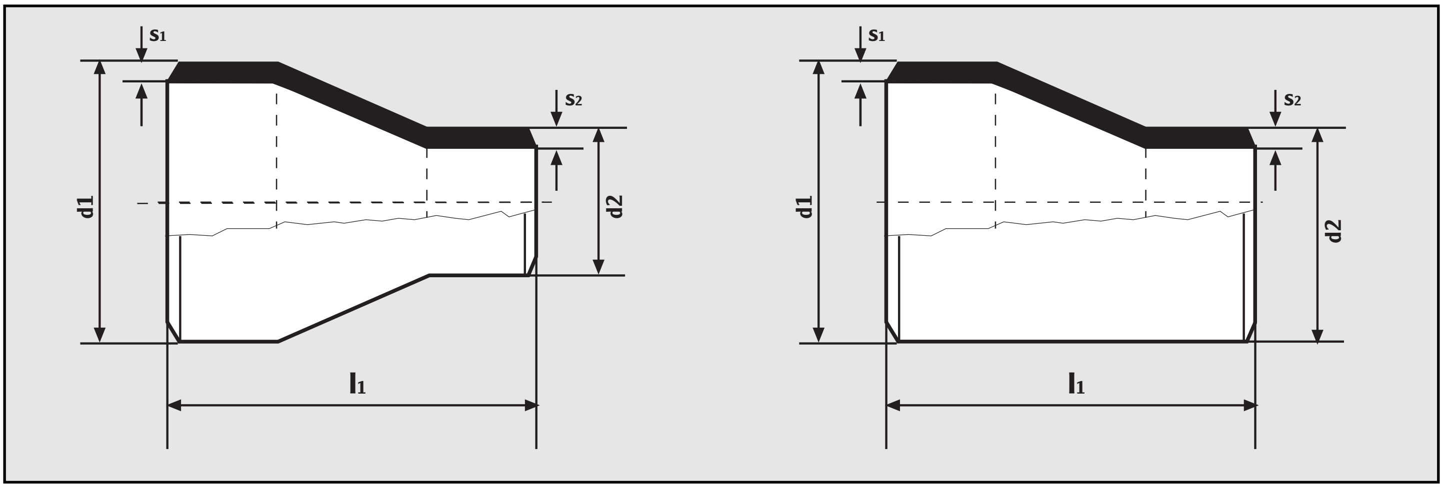


s = seamless, w = welded

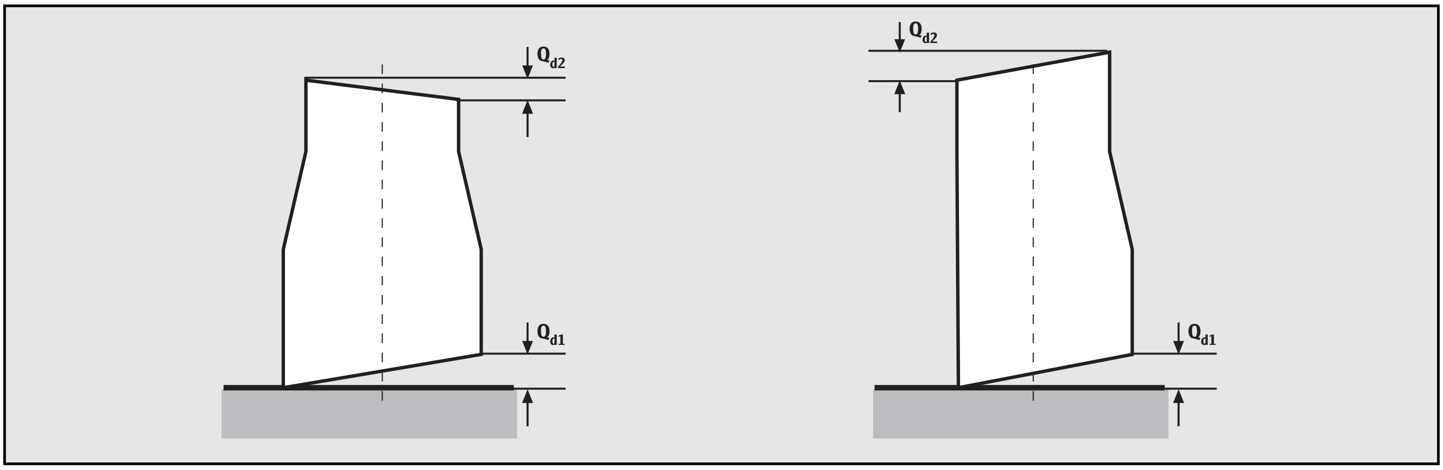
Size						Pieces		
d1	x	s1	d2	x	s2	kg	a	b
139.7	x	4.0	114.3	x	3.6	s	4.70	124	117
139.7	x	4.0	88.9	x	3.2	s	4.60	124	111
139.7	x	6.3	114.3	x	6.3	s	7.20	124	117
139.7	x	6.3	88.9	x	5.6	s	7.00	124	111
139.7	x	6.3	76.1	x	5.0	s	6.80	124	108
139.7	x	10.0	114.3	x	8.8	s	11.30	124	117
139.7	x	10.0	88.9	x	8.0	s	11.00	124	111
139.7	x	10.0	76.1	x	7.1	s	10.90	124	108
168.3	x	2.6	139.7	x	2.6	w*	5.30	143	137
168.3	x	2.6	114.3	x	2.6	w*	5.30	143	130
168.3	x	2.6	88.9	x	2.3	w*	5.00	143	124
168.3	x	4.5	139.7	x	4.5	s	6.90	143	137
168.3	x	4.5	114.3	x	3.6	s	6.70	143	130
168.3	x	4.5	88.9	x	3.2	s	6.60	143	124
168.3	x	7.1	139.7	x	6.3	s	10.80	143	137
168.3	x	7.1	114.3	x	6.3	s	10.70	143	130
168.3	x	7.1	88.9	x	5.6	s	10.40	143	124
168.3	x	11.0	139.7	x	11.0	s	16.60	143	137
168.3	x	11.0	114.3	x	8.8	s	16.30	143	130
168.3	x	11.0	88.9	x	8.0	s	16.00	143	124
219.1	x	2.9	168.3	x	2.6	w*	7.20	178	168
219.1	x	2.9	139.7	x	2.6	w*	7.20	178	162
219.1	x	2.9	114.3	x	2.6	w*	7.00	178	156
219.1	x	6.3	168.3	x	4.5	s	14.40	178	168
219.1	x	6.3	139.7	x	4.0	s	13.60	178	162
219.1	x	6.3	114.3	x	3.6	s	13.60	178	156
219.1	x	6.3	88.9	x	3.2	s	13.60	178	152
219.1	x	8.0	168.3	x	7.1	s	18.40	178	168
219.1	x	8.0	139.7	x	6.3	s	17.40	178	162
219.1	x	8.0	114.3	x	6.3	s	17.40	178	156
219.1	x	8.0	88.9	x	5.6	s	17.40	178	152
219.1	x	12.5	168.3	x	11.0	s	28.80	178	168
219.1	x	12.5	139.7	x	10.0	s	27.60	178	162
219.1	x	12.5	114.3	x	8.8	s	27.60	178	156
219.1	x	12.5	88.9	x	8.0	s	27.60	178	152

The * marked items are manufactured with following wall thicknesses
21.3 with 2.0
26.9 with 2.0
88.9 with 2.6
139.7 with 2.9
168.3 with 2.9



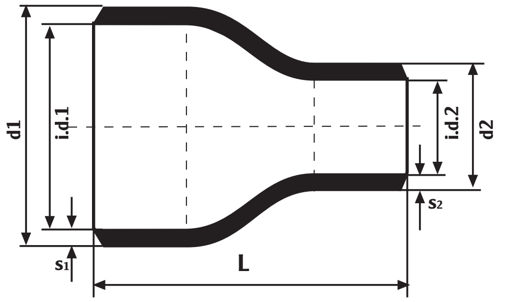


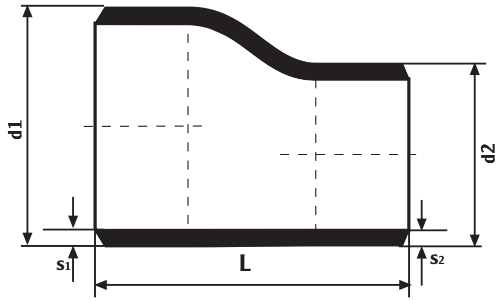
Tolerances



Outside Ø da mm	Standard								Special Requirements	
	d_{1+2}	Q	l1 mm		Wall thickness S_{1+2}	Ovality Welding edge	Ovality body	di	d_{1+2}	Q
21,3 - 76,1	± 1 %	1 %	±2,5		Smin		4 %	di min:	± 0,4 mm	0,5 %
- 114,3	min.	v.da	±3,0		(Body)	da	4 %	0,8x	± 0,4 mm	v.da
- 219,1	0,5 mm	min.	± 3,5		-12,5 %	Tolerance	4 %	di-tube	± 0,5 %	min.
- 273		1,0 mm	± 4,0			2 %	4 %	(theor.di)	± 0,6 %	0,5 mm
- 323,9			± 5,0		Smax	2 %	4 %	des	± 0,6 %	
					(Welding -					
					edge):					
					+ 15 %					

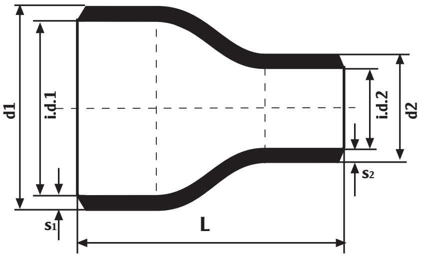
d1+2 = OD at welding edge
S1+2 = WT at welding edge

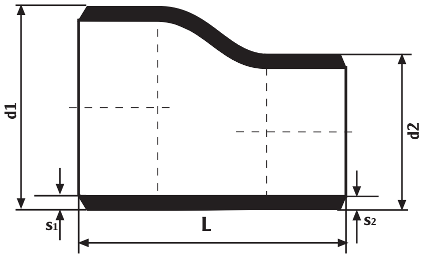




Tube outside d1 mm	WT s1 mm	Tube outside d2 mm	WT s2 mm	Length conc/ecc L mm	Weight approx. kg
21.3	2.0	17.2	1.8	38	0.03
	3.2	17.2	2.9	38	0.05
	4.0	17.2	2.9	38	0.06
26.9	2.3	21.3	2.0	38	0.05
		17.2	1.8	38	0.05
	3.2	21.3	3.2	38	0.06
		17.2	2.9	38	0.06
	4.0	21.3	4.0	38	0.08
		17.2	3.2	38	0.08
30.0	2.6	26.9	2.3	50	0.08
		25.0	2.0	50	0.08
		21.3	2.0	50	0.08
		20.0	2.0	50	0.08
33.7	2.6	26.9	2.3	50	0.09
		21.3	2.0	50	0.09
	3.2	26.9	3.2	50	0.11
		21.3	3.2	50	0.11
	4.0	26.9	4.0	50	0.18
		21.3	4.0	50	0.18
38.0	2.6	33.7	2.6	50	0.10
		30.0	2.6	50	0.10
		26.9	2.3	50	0.10
		25.0	2.0	50	0.10
		21.3	2.0	50	0.10
		20.0	2.0	50	0.10
42.4	2.6	33.7	2.6	50	0.11
		26.9	2.3	50	0.11
		21.3	2.0	50	0.11
	3.6	33.7	3.2	50	0.14
		26.9	3.2	50	0.14
		21.3	3.2	50	0.14
	4.0	33.7	4.0	50	0.17
		26.9	4.0	50	0.17
		21.3	4.0	50	0.17

Tube outside d1 mm	WT s1 mm	Tube outside d2 mm	WT s2 mm	Length conc/ecc L mm	Weight approx. kg
44.5	2.6	38.0	2.6	64	0.15
		33.7	2.6	64	0.15
		30.0	2.6	64	0.15
		26.9	2.3	64	0.15
		25.0	2.0	64	0.15
		21.3	2.0	64	0.15
		20.0	2.0	64	0.15
48.3	2.6	42.4	2.6	64	0.17
		33.7	2.6	64	0.17
		26.9	2.3	64	0.17
	4.0	42.4	3.6	64	0.27
		33.7	3.2	64	0.27
		26.9	3.2	64	0.27
	5.0	42.4	4.0	64	0.31
		33.7	4.0	64	0.31
		26.9	4.0	64	0.31
57.0	2.9	48.3	2.6	76	0.26
		44.5	2.6	76	0.26
		42.4	2.6	76	0.26
		38.0	2.6	76	0.26
		33.7	2.6	76	0.26
		30.0	2.6	76	0.26
		26.9	2.3	76	0.26
		25.0	2.0	76	0.26
		21.3	2.0	76	0.26
		20.0	2.0	76	0.26
60.3	2.9	48.3	2.6	76	0.28
		42.4	2.6	76	0.28
		33.7	2.6	76	0.28
		26.9	2.3	76	0.28
		21.3	2.0	76	0.28
	4.5	48.3	4.0	76	0.37
		42.4	3.6	76	0.37
		33.7	3.2	76	0.37
		26.9	3.2	76	0.37
		21,3	3,2	76	0,37



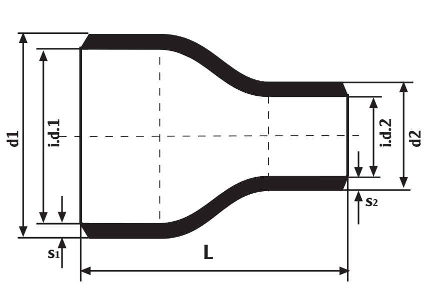


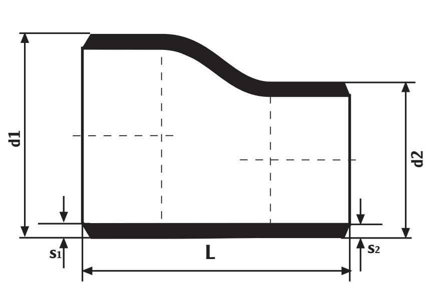
Tube outside d1 mm	WT s1 mm	Tube outside d2 mm	WT s2 mm	Length conc/ecc L mm	Weight approx. kg
	5.6	48.3	5.0	76	0.52
		42.4	4.0	76	0.52
		33.7	4.0	76	0.52
		26.9	4.0	76	0.52
70.0	2.9	60.3	2.9	90	0.39
		57.0	2.9	90	0.39
		48.3	2.6	90	0.39
		44.5	2.6	90	0.39
		42.4	2.6	90	0.39
		38.0	2.6	90	0.39
		33.7	2.6	90	0.39
		30.0	2.6	90	0.39
76.1	2.9	60.3	2.9	90	0.42
		57.0	2.9	90	0.42
		48.3	2.6	90	0.42
		42.4	2.6	90	0.42
		38.0	2.6	90	0.42
		33.7	2.6	90	0.42
		30.0	2.6	90	0.42
	5.0	60.3	4.5	90	0.71
		48.3	4.0	90	0.71
		42.4	3.6	90	0.71
		33.7	3.2	90	0.71
	7.1	60.3	5.6	90	0.98
		48.3	5.0	90	0.98
		42.4	4.0	90	0.98
		33.7	4.0	90	0.98
88.9	3.2	76.1	2.9	90	0.55
		70.0	2.9	90	0.55
		60.3	2.9	90	0.55
		57.0	2.9	90	0.55
		48.3	2.6	90	0.55
		44.5	2.6	90	0.55
		42.4	2.6	90	0.55
		33.7	2.6	90	0.55
		30.0	2.6	90	0.55
	5.6	76.1	5.0	90	0.93
		60.3	4.5	90	0.93
		48.3	4.0	90	0.93
		42.4	3.6	90	0.93
	8.0	76.1	7.1	90	1.30
		60.3	5.6	90	1.30
		48.3	5.0	90	1.30
		42.4	4.0	90	1.30
101.6	3.6	88.9	3.2	100	0.78
		76.1	2.9	100	0.78
		60.3	2.9	100	0.78
		57.0	2.9	100	0.78
		48.3	2.6	100	0.78

Tube outside d1 mm	WT s1 mm	Tube outside d2 mm	WT s2 mm	Length conc/ecc L mm	Weight approx. kg
108.0	3.6	88.9	3.2	100	0.85
		76.1	2.9	100	0.85
		70.0	2.9	100	0.85
		60.3	2.9	100	0.85
		57.0	2.9	100	0.85
		48.3	2.6	100	0.85
		44.5	2.6	100	0.85
		42.4	2.6	100	0.85
		38.0	2.6	100	0.85
		30.0	2.6	100	0.85
114.3	3.6	101.6	3.6	100	0.98
		88.9	3.2	100	0.98
		76.1	2.9	100	0.98
		60.3	2.9	100	0.98
		57.0	2.9	100	0.98
		48.3	2.6	100	0.98
		44.5	2.6	100	0.98
		42.4	2.6	100	0.98
	6.3	88.9	5.6	100	1.68
		76.1	5.0	100	1.68
		60.3	4.5	100	1.68
		48.3	4.0	100	1.68
	8.8	88.9	8.0	100	2.29
		76.1	7.1	100	2.29
		60.3	5.6	100	2.29
		48.3	5.0	100	2.29
133.0	4.0	114.3	3.6	127	1.61
		108.0	3.6	127	1.61
		88.9	3.2	127	1.61
		76.1	2.9	127	1.61
		60.3	2.9	127	1.61
		57.0	2.9	127	1.61
139.7	4.0	114.3	3.6	127	1.70
		108.0	3.6	127	1.70
		101.6	3.6	127	1.70
		88.9	3.2	127	1.70
		76.1	2.9	127	1.70
		60.3	2.9	127	1.70
	6.3	114.3	6.3	127	2.63
		88.9	5.6	127	2.63
		76.1	5.0	127	2.63
		60.3	4.5	127	2.63
	10	114.3	8.8	127	4.06
		88.9	8.0	127	4.06
		76.1	7.1	127	4.06
		60.3	5.6	127	4.06

REDUCER

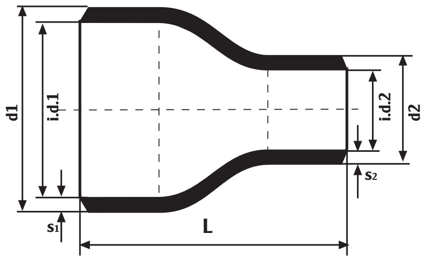
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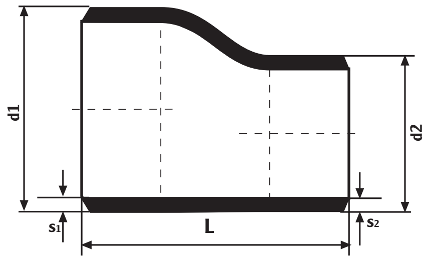




Tube outside d1 mm	WT s1 mm	Tube outside d2 mm	WT s2 mm	Length conc/ecc L mm	Weight approx. kg
159.0	4.5	139.7	4.0	140	2.39
		133.0	4.0	140	2.39
		114.3	3.6	140	2.39
		108.0	3.6	140	2.39
		88.9	3.2	140	2.39
		76.1	2.9	140	2.39
		60.3	2.9	140	2.39
		57.0	2.9	140	2.39
168.3	4.5	139.7	4.0	140	2.55
		133.0	4.0	140	2.55
		114.3	3.6	140	2.55
		108.0	3.6	140	2.55
		88.9	3.2	140	2.55
		76.1	2.9	140	2.55
		60.3	2.9	140	2.55
	7.1	139.7	6.3	140	3.95
		114.3	6.3	140	3.95
		88.9	5.6	140	3.95
		76.1	5.0	140	3.95
	11.0	139.7	10.0	140	5.98
		114.3	8.8	140	5.98
		88.9	8.0	140	5.98
		76.1	7.1	140	5.98
193.7	5.6	168.3	4.5	152	3.95
		139.7	4.0	152	3.95
		133.0	4.0	152	3.95
		114.3	3.6	152	3.95
		108.0	3.6	152	3.95
219.1	6.3	193.7	5.6	152	5.03
		168.3	4.5	152	5.03
		159.0	4.5	152	5.03
		139.7	4.0	152	5.03
		133.0	4.0	152	5.03
		114.3	3.6	152	5.03
		108.0	3.6	152	5.03
		88.9	3.2	152	5.03
	8.0	168.3	7.1	152	6.32
		139.7	6.3	152	6.32
		114.3	6.3	152	6.32
		88.9	5.6	152	6.32
	12.5	168.3	11.0	152	9.68
		139.7	10.0	152	9.68
		114.3	8.8	152	9.68
		88.9	8.0	152	9.68
267.0	6.3	219.1	6.3	178	7.36
		193.7	6.3	178	7.36
		168.3	4.5	178	7.36
		159.0	4.5	178	7.36
		139.7	4.0	178	7.36
		133.0	4.0	178	7.36

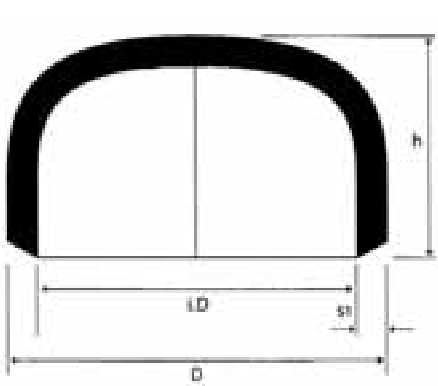
Tube outside d1 mm	WT s1 mm	Tube outside d2 mm	WT s2 mm	Length conc/ecc L mm	Weight approx. kg
273.0	6.3	219.1	6.3	178	7.36
		193.7	6.3	178	7.36
		168.3	4.5	178	7.36
		159.0	4.5	178	7.36
		139.7	4.0	178	7.36
		133.0	4.0	178	7.36
		114.3	3.6	178	7.36
		108.0	3.6	178	7.36
	8.8	219.1	8.0	178	10.2
		168.3	7.1	178	10.2
		139.7	6.3	178	10.2
		114.3	6.3	178	10.2
	14.2	219.1	12.5	178	16.1
		168.3	11.0	178	16.1
		139.7	10.0	178	16.1
		114.3	8.8	178	16.1
323.9	7.1	273.0	6.3	203	11.1
		219.1	6.3	203	11.1
		193.7	5.6	203	11.1
		168.3	4.5	203	11.1
		159.0	4.5	203	11.1
		139.7	4.0	203	11.1
	10.0	273.0	8.0	203	15.7
		219.1	8.0	203	15.7
		168.3	7.1	203	15.7
		139.7	6.3	203	15.7
	16.0	273.0	14.2	203	24.5
		219.1	12.5	203	24.5
		168.3	11.0	203	24.5
		139.7	10.0	203	24.5
355.6	8.0	323.9	7.1	330	22.6
		273.0	6.3	330	22.6
		219.1	6.3	330	22.6
		168.3	4.5	330	22.6
	11.0	323.9	10.0	330	30.8
		273.0	8.8	330	30.8
		219.1	8.0	330	30.8
		168.3	7.1	330	30.8
	17.5	323.9	16.0	330	48.1
		273.0	14.2	330	48.1
		219.1	12.5	330	48.1
		168.3	11.0	330	48.1





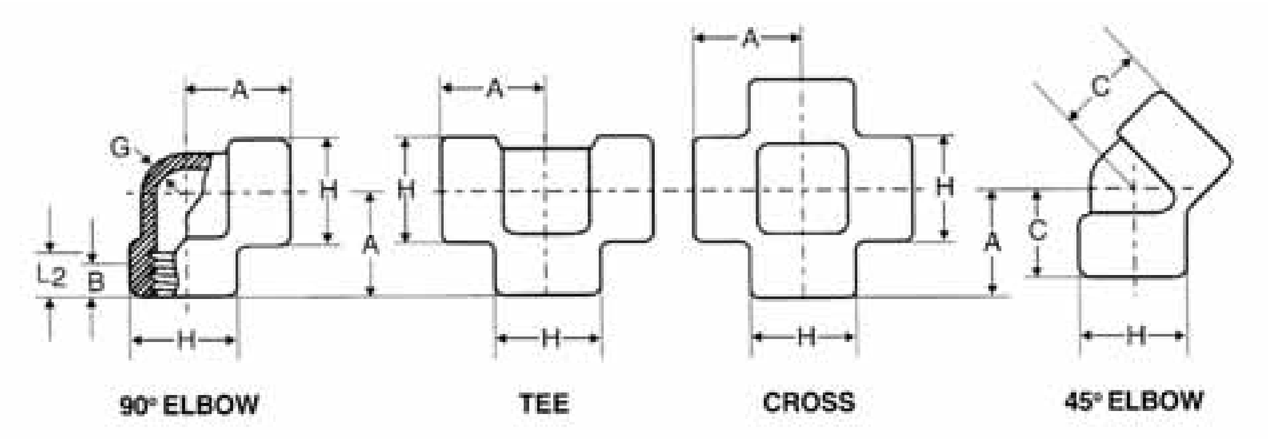
Tube outside d1 mm	WT s1 mm	Tube outside d2 mm	WT s2 mm	Length conc/ecc L mm	Weight approx. kg
406.4	8.8	355.6	8.0	355	30.6
		323.9	7.1	355	30.6
		273.0	6.3	355	30.6
		219.1	6.3	355	30.6
	12.5	355.6	11.0	355	42.9
		323.9	10.0	355	42.9
		273.0	8.8	355	42.9
		219.1	8.0	355	42.9
	20.0	355.6	17.5	355	67.8
		323.9	16.0	355	67.8
		273.0	14.2	355	67.8
		219.1	12.5	355	67.8
419.0	10.0	368.0	8.0	355	35.8
		355.6	8.0	355	35.8
		323.9	7.1	355	35.8
		273.0	6.3	355	35.8
		267.0	6.3	355	35.8
		219.1	6.3	355	35.8
457.0	10.0	419.0	10.0	381	41.9
		406.4	8.8	381	41.9
		355.6	8.0	381	41.9
		323.9	7.1	381	41.9
		273.0	6.3	381	41.9
		219.1	6.3	381	41.9
	14.2	406.4	12.5	381	59.0
		355.6	11.0	381	59.0
		323.9	10.0	381	59.0
		273.0	8.8	381	59.0
	22.2	406.4	20.0	381	90.6
		355.6	17.5	381	90.6
		323.9	16.0	381	90.6
		273.0	14.2	381	90.6

Tube outside d1 mm	WT s1 mm	Tube outside d2 mm	WT s2 mm	Length conc/ecc L mm	Weight approx. kg
508.0	11.0	457.0	10.0	508	68.5
		406.4	8.8	508	68.5
		355.6	8.0	508	68.5
		323.9	7.1	508	68.5
		273.0	6.3	508	68.5
		219.1	6.3	508	68.5
	16.0	457.0	14.2	508	98.5
		406.4	12.5	508	98.5
		355.6	11.0	508	98.5
		323.9	10.0	508	98.5
		273.0	8.8	508	98.5
		219.1	8.0	508	98.5
	25.0	457.0	22.2	508	151
		406.4	20.0	508	151
		355.6	17.5	508	151
		323.9	16.0	508	151
		273.0	14.2	508	151
		219.1	12.5	508	151
610.0	12.5	508.0	11.0	508	93.4
		457.0	10.0	508	93.4
		406.4	8.8	508	93.4
		355.6	8.0	508	93.4
		323.9	7.1	508	93.4
	17.5	508.0	16.0	508	130
		457.0	14.2	508	130
		406.4	12.5	508	130
		355.6	11.0	508	130
		323.9	10.0	508	130
	30.0	508.0	25.0	508	217
		457.0	22.2	508	217
		406.4	20.0	508	217
		355.6	17.5	508	217
		323.9	16.0	508	217



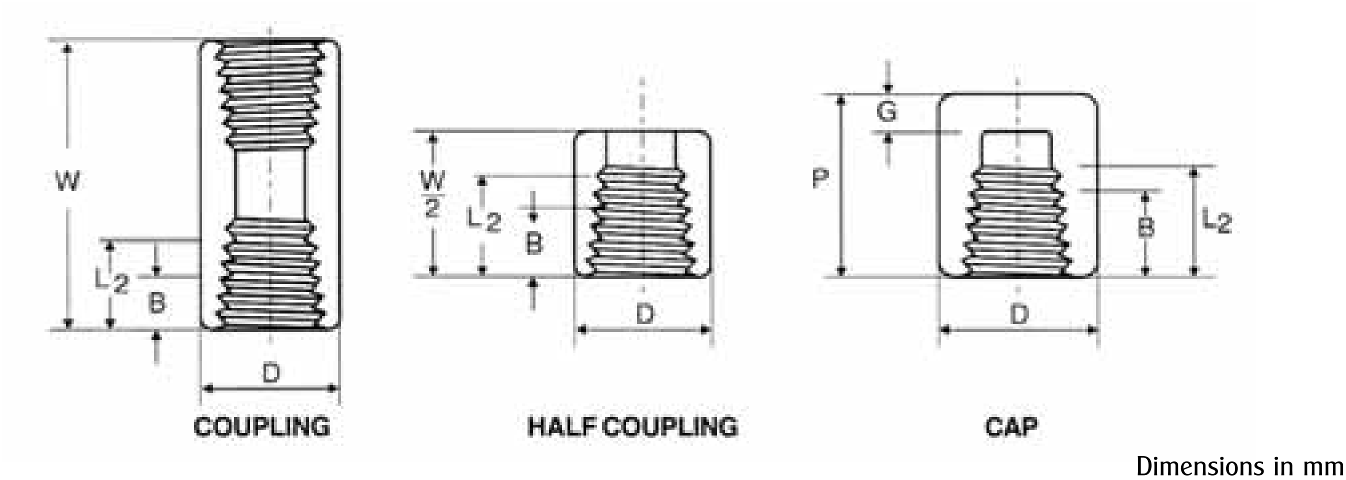
Tube	Wallthickness			Height	Weight		
OD Ø D mm	Row 3 s mm	Row 4 s mm	Row 5 s mm	h approx. mm	Row 3 approx. kg	Row 4 approx. kg	Row 5 approx. kg
21.3	2.0	3.2	4.0	25	0.06	0.10	0.13
26.9	2.3	3.2	4.0	25	0.07	0.11	0.14
33.7	2.6	3.2	4.0	38	0.09	0.13	0.15
42.4	2.6	3.6	4.0	38	0.11	0.14	0.16
48.3	2.6	4.0	5.0	38	0.20	0.22	0.23
60.3	2.9	4.5	5.6	38	0.28	0.30	0.34
76.1	2.9	5.0	7.1	38	0.34	0.50	0.71
88.9	3.2	5.6	8.0	51	0.53	0.70	0.95
114.3	3.6	6.3	8.8	64	1.00	1.50	1.72
139.7	4.0	6.3	10.0	76	1.14	1.60	2.86
168.3	4.5	7.1	11.0	89	2.65	3.55	5.30
219.1	6.3	8.0	12.5	102	5.55	6.70	10.35
273.0	6.3	8.8	14.2	127	8.00	8.80	14.00
323.9	7.1	10.0	16.0	152	9.90	14.00	22.50
355.6	8.0	11.0	17.5	165	13.50	18.50	29.50
406.4	8.8	12.5	20.0	178	18.20	26.60	42.50
457.0	10.0	14.2	22.0	203	26.00	38.50	60.00
508.0	11.0	16.0	25.0	229	38.00	54.00	84.00
610.0	12.5	17.5	30.0	267	60.80	83.00	143.00





DN	Nom. Pipe Size	Centre to End Elbows, Tees, Cross A			Centre to End 45° Elbow C			Outside Diameter of Band H			Minimum Wall Thickness G			Length of Thread Min.(1)	
		2000	3000	6000	2000	3000	6000	2000	3000	6000	2000	3000	6000	B	L2
6	1/8	21	21	25	17	17	19	22	22	25	3.18	3.18	6.35	6.4	6.7
8	1/4	21	25	28	17	19	22	22	25	33	3.18	3.30	6.60	8.1	10.2
10	3/8	25	28	33	19	22	25	25	33	38	3.18	3.51	6.98	9.1	10.4
15	1/2	28	33	38	22	25	28	33	38	46	3.18	4.09	8.15	10.9	13.6
20	3/4	33	38	44	25	28	33	38	46	56	3.18	4.32	8.53	12.7	13.9
25	1	38	44	51	28	33	35	46	56	62	3.68	4.98	9.93	14.7	17.3
32	1-1/4	44	51	60	33	35	43	56	62	75	3.89	5.28	10.59	17.0	18.0
40	1-1/2	51	60	64	35	43	44	62	75	84	4.01	5.56	11.07	17.8	18.4
50	2	60	64	83	43	44	52	75	84	102	4.27	7.14	12.09	19.0	19.2
65	2-1/2	76	83	95	52	52	64	92	102	121	5.61	7.65	15.29	23.6	28.9
80	3	86	95	106	64	64	79	109	121	146	5.99	8.84	16.64	25.9	30.5
100	4	106	114	114	79	79	79	146	152	152	6.55	11.18	18.67	27.7	33.0

1. Dimension B is minimum length of perfect thread. The length of useful thread (B plus threads with fully normed roots and flat crests) shall not be less than L2 (effective length of external thread) required by American National Standard for Pipe Threads (ANSI/ASME B1.20.1).

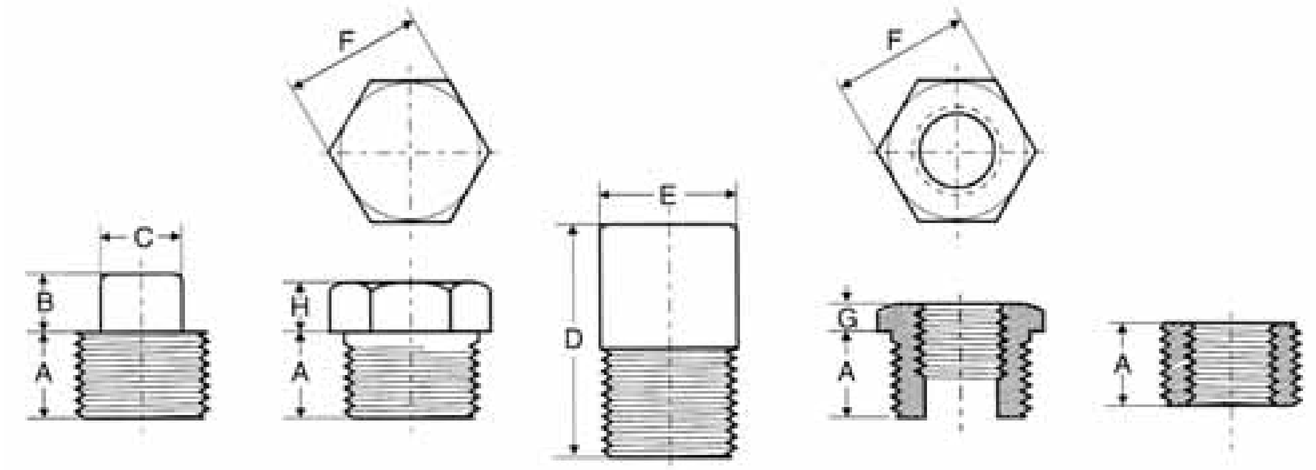


Dimensions in mm

DN	Nom. Pipe Size	End to End Couplings W	End to End Couplings P		Outside Diameter D		End Wall Thickness G	Min.	Length of Thread Min.(1)	
		3000&6000	3000	6000	3000	6000	3000	6000	B	L2
6	1/8	32	19	...	16	22	4.8	...	6.4	6.7
8	1/4	35	25	27	19	25	4.8	6.4	8.1	10.2
10	3/8	38	25	27	22	32	4.8	6.4	9.1	10.4
15	1/2	48	32	33	28	38	6.4	7.9	10.9	13.6
20	3/4	51	37	38	35	44	6.4	7.9	12.7	13.9
25	1	60	41	43	44	57	9.7	11.2	14.7	17.3
32	1-1/4	67	44	46	57	64	9.7	11.2	17.0	18.0
40	1-1/2	79	44	48	64	76	11.2	12.7	17.8	18.4
50	2	86	48	51	76	92	12.7	15.7	19.0	19.2
65	2-1/2	92	60	64	92	108	15.7	19.0	23.6	28.9
80	3	108	65	68	108	127	19.0	22.4	25.9	30.5
100	4	121	68	75	140	159	22.4	28.4	27.7	33.0

1. Dimension B is minimum length of perfect thread. The length of useful thread (B plus threads with fully normed roots and flat crests) shall not be less than L2 (effective length of external thread) required by American National Standard for Pipe Threads (ANSI/ASME B1.20.1).

2. Class 2000 and NPS 1/8 (DN6) class 6000 couplings, half couplings, and caps are not included in this standard.

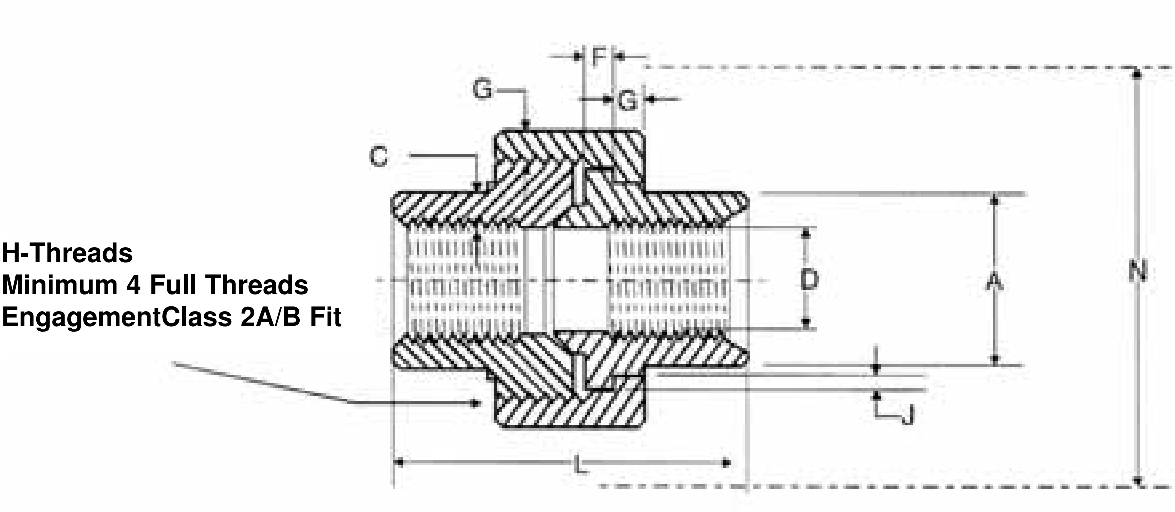


SQUARE HEAD PLUG | HEX HEAD PLUG | ROUND HEAD PLUG | HEX HEAD(1) BUSHING | FLUSH BUSHING

Dimensions in mm

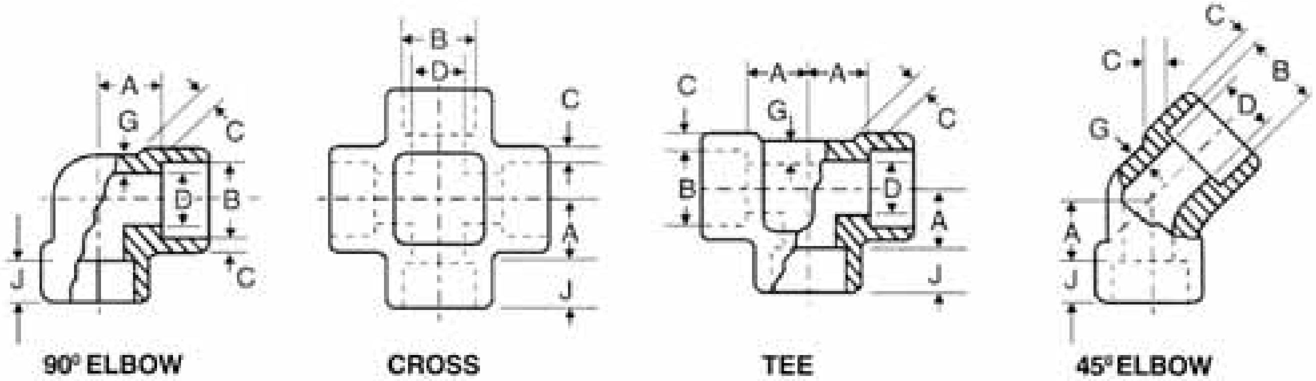
DN	Nom. Pipe Size	Length (Min.) A	Plugs Square Head		Plugs Square Head		Hex Plugs & Bushings		
			Height of Square (Min.) B	Width Flats (Min.) C	Nominal Diameter of Head E	Length (Min.) D	Width Flats (Nom.) F	Hex Height (Min.) Bushing G	Hex Height (Min.) Plug H
6	1/8	10	6	7	10	35	11	...	6
8	1/4	11	6	10	14	41	16	3	6
10	3/8	13	8	11	18	41	18	4	8
15	1/2	14	10	14	21	44	22	5	8
20	3/4	16	11	16	27	44	27	6	10
25	1	19	13	21	33	51	36	6	10
32	1-1/4	21	14	24	43	51	46	7	14
40	1-1/2	21	16	28	48	51	50	8	16
50	2	22	18	32	60	64	65	9	18
65	2-1/2	27	19	36	73	70	75	10	19
80	3	28	21	41	89	70	90	10	21
100	4	32	25	65	114	76	115	13	25

1. CAUTIONARY NOTE REGARDING HEX BRUSHINGS. Hex Head Brushings of one-size reduction should not be used in services wherein they might be subject to harmful loads and forces other than external pressures.



Dimensions in mm

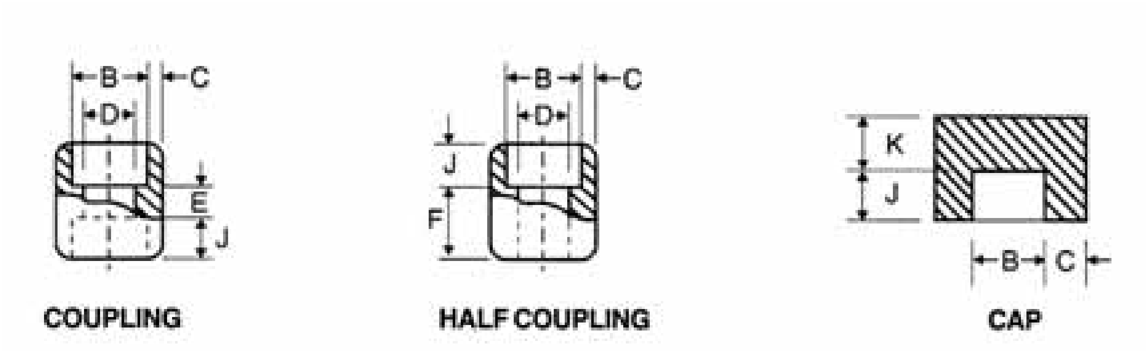
Nom. Pipe Size	Pipe End Min. A	Wall Min. C	Water Way Bore D	Male Flange Min. F	Nut Min. G	Theads Per 25.4 mm Max. H	Bearing Min. J	Length Assem. Nom. L	Clear Assem. Nut N
1/8	14.7	2.41	6.83 6.43	3.17	3.2	16	1.24	41.4	49.0
1/4	19.0	3.02	9.85 9.45	3.17	3.2	16	1.24	41.4	49.0
3/8	22.9	3.20	13.92 13.51	3.43	3.4	14	1.37	46.0	55.0
1/2	27.7	3.73	17.47 17.07	3.68	3.7	14	1.50	49.0	57.0
3/4	33.5	3.91	21.79 21.39	4.06	4.1	11	1.68	56.9	67.0
1	41.4	4.55	28.14 27.74	4.57	4.4	11	1.85	62.0	79.0
1-1/4	50.5	4.85	35.76 35.36	5.33	5.2	11	2.13	71.1	94.0
1-1/2	57.2	5.08	41.61 41.20	5.84	5.6	10	2.31	76.4	111.0
	70.1	5.54	52.53 52.12	6.60	6.4	10	2.69	86.1	132.0
2-1/2	85.3	7.01	64.72 64.31	7.49	7.1	8	3.07	102.4	148.0
3	102.4	7.62	77.67 77.27	8.25	8.0	8	3.53	109.0	175.0



Dimensions in mm

	Nom. DN Size	Socket Pipe Dia.(2) B	Bore Diameter of Fitting (2) Bore D Class Designation 3000	6000	9000	Socket Wall Thickness (1) C Class Designation 3000 Ave.	3000 Min.	6000 Ave.	6000 Min.	9000 Ave.	9000 Min.	Body Wall Thickness G 3000 Min.	6000 Min.	9000 Min.	Depth of Socket Min. J
6	1/8	11.2 10.8	7.6 6.1	4.8 3.2		3.18	3.18	3.96	3.43			2.41	3.15		9.5
8	1/4	14.6 14.2	10.0 8.5	7.1 5.6		3.78	3.30	4.60	4.01			3.02	3.68		9.5
10	3/8	18.0 17.6	13.3 11.8	9.9 8.4		4.01	3.50	5.03	4.37			3.20	4.01		9.5
15	1/2	22.2 21.8	16.6 15.0	12.5 11.0	7.2 5.6	4.67	4.09	5.97	5.18	9.35	8.18	3.73	4.78	7.47	9.5
20	3/4	27.6 27.2	21.7 20.2	16.3 14.8	11.8 10.3	4.90	4.27	6.96	6.04	9.78	8.56	3.91	5.56	7.82	12.5
25	1	34.3 33.9	27.4 25.9	21.5 19.9	16.0 14.5	5.69	4.98	7.92	6.93	11.38	9.96	4.55	6.35	9.09	12.5
32	1-1/4	43.1 42.7	35.8 34.3	30.2 28.7	23.5 22.0	6.07	5.28	7.92	6.93	12.14	10.62	4.85	6.35	9.70	12.5
40	1-1/2	49.2 48.8	41.6 40.1	34.7 33.2	28.7 27.2	6.35	5.54	8.92	7.80	12.7	11.12	5.08	7.14	10.15	12.5
50	2	61.7 61.2	53.3 51.7	43.6 42.1	38.9 37.4	6.93	6.04	10.92	9.50	13.84	12.12	5.54	8.74	11.07	16.0
65	2-1/2	74.4 73.9	64.2 61.2			8.76	7.67					7.01			16.0
80	3	90.3 89.8	79.4 76.4			9.52	8.30					7.62			16.0
100	4	115.7 115.2	103.8 100.7			10.69	9.35					8.56			19.0

Notes:
1. Average of Socket Wall Thickness around periphery shall be no less than listed values. The minimum values are permitted in localized areas.
2. Upper and lower values for each size are the respective maximum and minimum dimensions.



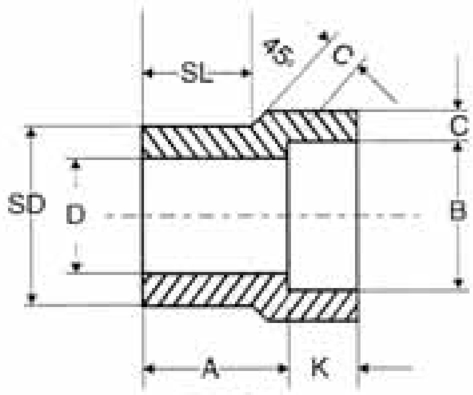
Dimensions in mm

DN	Nom. Pipe Size	Centre to Bottom of Socket-A: 90° Elbows Tees, Crosses, Class Designation 3000	6000	9000	45° Elbows, Class Designation 3000	6000	9000	Laying Lengths: C-lings E	Half C-lings F	Tolerances± A	E	F	End Wall Thickness K Min., Class Designation 3000	6000	9000
6	1/8	11.0	11.0		8.0	8.0		6.5	16.0	1.0	1.5	1.0	4.8	6.4	
8	1/4	11.0	13.5		8.0	8.0		6.5	16.0	1.0	1.5	1.0	4.8	6.4	
10	3/8	13.5	15.5		8.0	11.0		6.5	17.5	1.5	3.0	1.5	4.8	6.4	
15	1/2	15.5	19.0	25.5	11.0	12.5	15.5	9.5	22.5	1.5	3.0	1.5	6.4	7.9	11.2
20	3/4	19.0	22.5	28.5	13.0	14.0	19.0	9.5	24.0	1.5	3.0	1.5	6.4	7.9	12.7
25	1	22.5	27.0	32.0	14.0	17.5	20.5	12.5	28.5	2.0	4.0	2.0	9.6	11.2	14.2
32	1-3/4	27.0	32.0	35.0	17.5	20.5	22.5	12.5	30.0	2.0	4.0	2.0	9.6	11.2	14.2
40	1-1/2	32.0	38.0	38.0	20.5	25.5	25.5	12.5	32.0	2.0	4.0	2.0	11.2	12.7	15.7
50	2	38.0	41.0	54.0	25.5	28.5	28.5	19.0	41.0	2.0	4.0	2.0	12.7	15.7	19.0
65	2-1/2	41.0			28.5			19.0	43.0	2.5	5.0	2.5	15.7	19.0	
80	3	57.0			32.0			19.0	44.5	2.5	5.0	2.5	19.0	22.4	
100	4	66.5			41.0			19.0	48.0	2.5	5.0	2.5	22.4	28.4	

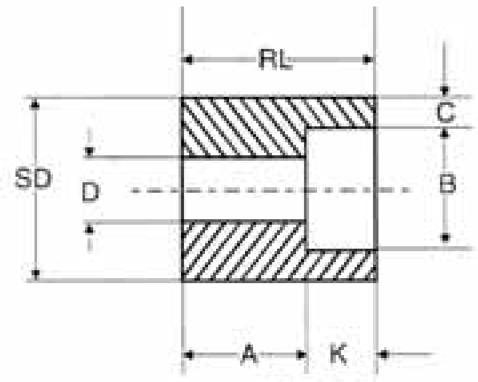
Notes:

1. Average of Socket Wall Thickness around periphery shall be no less than listed values. The minimum values are permitted in localized areas.
2. Upper and lower values for each size are the respective maximum and minimum dimensions.

MSS SP-79



TYPE 1

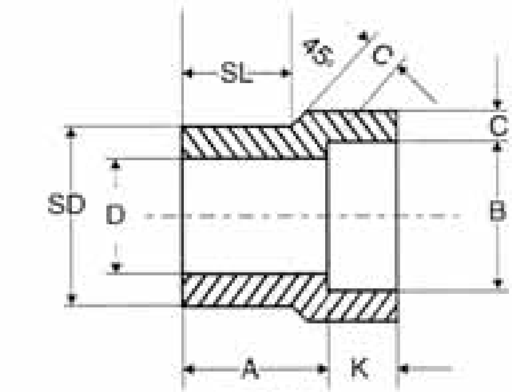


TYPE 2 [1]

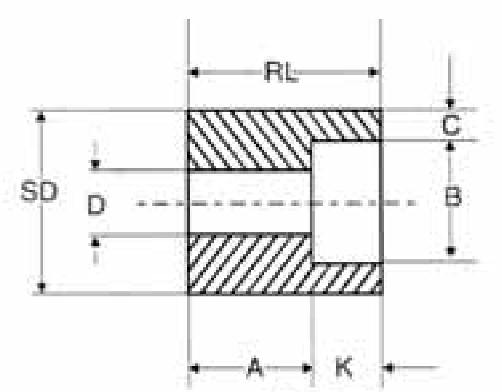
Dimensions in mm

Nom. Pipe Size	Type (2)		Socket		Shank Dia.	Laying Length A		Bore D		Wall Min. C		Length			
			Dia	Depth Min.								SL		RL (Min.)	
	3M	6M	B	K	SD	3M	6M	3M	6M	3M	6M	3M	6M	3M	6M
3/8 x 1/4	1	1	14.35	10	17.15	19	21	9.0	6.5	3.78	4.60	14	16		
1/2 x 3/8	1	1	17.78	10	21.34	21	23	12.5	9.0	4.01	5.03	16	16		
1/2 x 1/4	1	1	14.35	10	21.34	21	21	9.0	6.5	3.78	4.60	16	16		
3/4 x 1/2	1	1	21.97	10	26.67	22	25	16.0	11.5	4.67	5.97	17	19		
3/4 x 3/8	2	1	17.78	10	26.67	16	22	12.5	9.0	4.01	5.03		19	27	
3/4 x 1/4	2	2	14.35	10	26.67	18	22	9.0	6.5	3.78	4.60			27	32
1 x 3/4	1	1	27.31	13	33.49	24	28	21.0	15.5	4.90	6.96	19	21		
1 x 1/2	2	1	21.97	10	33.40	16	28	16.0	11.5	4.67	5.97		21	28	
1 x 3/8	2	2	17.78	10	33.40	18	22	12.5	9.0	4.01	5.03			28	33
1 x 1/4	2	2	14.35	10	33.40	19	24	9.0	6.5	3.78	4.60			28	33
1-1/4 x 1	1	1	34.04	13	42.16	25	30	26.5	20.5	5.69	7.92	21	22		
1-1/4 x 3/4	2	2	27.31	13	42.16	18	21	21.0	15.5	4.90	6.96			32	35
1-1/4 x 1/2	2	2	21.97	10	42.16	19	22	16.0	11.5	4.67	5.97			32	35
1-1/4 x 3/8	2	2	17.78	10	42.16	21	24	12.5	9.0	4.01	5.03			32	35
1-1/4 x 1/4	2	2	14.35	10	42.16	22	25	9.0	6.5	3.78	4.60			32	35
1-1/2 x 1-1/4	1	1	42.80	13	48.26	28	35	35.0	29.5	6.07	7.92	22	25		
1-1/2 x 1	2	1	34.04	13	48.26	18	29	26.5	20.5	5.69	7.92		25	33	
1-1/2 x 3/4	2	2	27.31	13	48.26	19	25	21.0	15.5	4.90	6.96			33	40
1-1/2 x 1/2	2	2	21.97	10	48.26	21	27	16.0	11.5	4.67	5.97			33	40
1-1/2 x 3/8	2	2	17.78	10	48.26	22	28	12.5	9.0	4.01	5.03			33	40
2 x 1-1/2	1	1	48.90	13	60.32	32	39	41.0	34.0	6.35	8.9	25	28		
2 x 1-1/4	2	2	42.80	13	60.32	21	24	35.0	29.5	6.07	7.92			38	41
2 x 1	2	2	34.04	13	60.32	22	25	26.5	21.0	5.69	7.92			38	41
2 x 3/4	2	2	27.31	13	60.32	24	27	21.0	15.5	4.90	6.96			38	41
2 x 1/2	2	2	21.97	10	60.32	25	28	16.0	11.5	4.67	5.97			38	41

1. At the option of the manufacturer Type 2 Reducers may be furnished in Type 1 configuration.
2. 3M & 6M symbols denote 3000 and 6000 classes.



TYPE 1



TYPE 2 (1)

Dimensions in mm

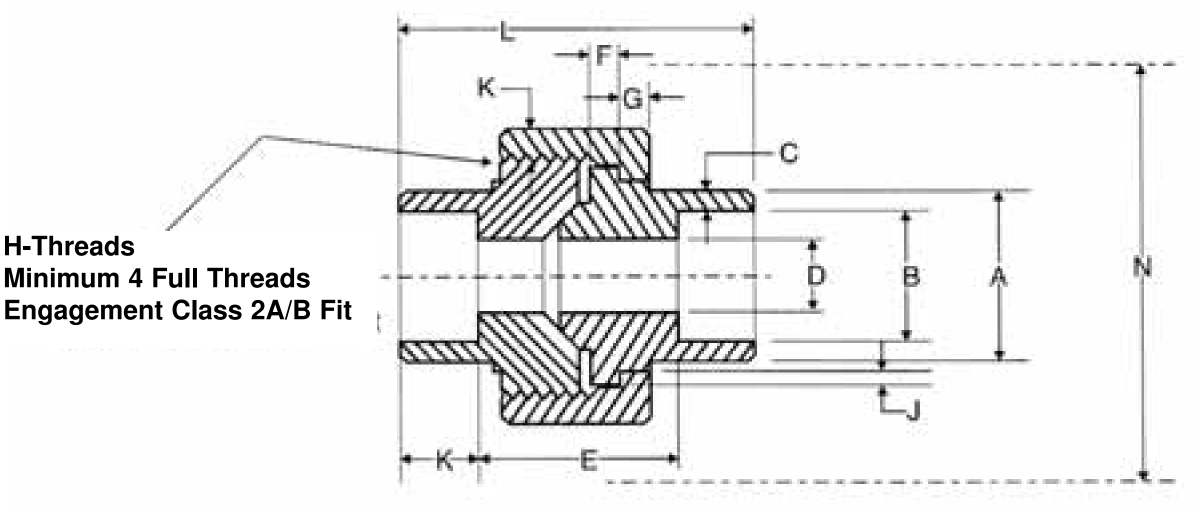
Nom. Pipe Size	Type (2)		Socket Dia	Socket Depth Min.	Shank Dia.	Laying Length A		Bore D		Wall Min. C		Length SL		Length RL (Min.)	
	3M	6M	B	K	SD	3M	6M	3M	6M	3M	6M	3M	6M	3M	6M
2-1/2 x 2	1	1	61.37	16	73.02	46	43	52.5	43.0	6.93	10.92	38	32		
2-1/2 x 1-1/2	2	2	48.90	13	73.02	35		41.0		6.35				54	
2-1/2 x 1-1/4	2	2	42.80	13	73.02	37		35.0		6.07				54	
2-1/2 x 1	2	2	34.04	13	73.02	38		26.5		5.69				54	
2-1/2 x 3/4	2	2	27.31	13	73.02	40		21.0		4.90				54	
3 x 2-1/2	1		74.07	16	88.90	38		62.5		8.76		32			
3 X 2			61.37	16	88.90	25		52.5		6.93				48	
3 x 1-1/2	2		48.90	13	88.90	29		41.0		6.35				48	
3 x 1-1/4	2		42.80	13	88.90	30		35.0		6.07				48	
3 x 1	2		34.04	13	88.90	32		26.5		5.69				48	
4 x 3	2		90.04	16	114.30	33		78.0		9.5				60	
4 x 2-1/2	2		74.07	16	114.30	38		62.5		8.76				60	
4 x 2			61.37	16	114.30	38		52.5		6.93				60	
4 x 1-1/2	2		48.90	13	114.30	42		41.0		6.35				60	
4 x 1-1/4	2		42.80	13	114.30	43		35.0		6.07				60	

1. At the option of the manufacturer Type 2 Reducers may be furnished in Type 1 configuration.
2. 3M & 6M symbols denote 3000 and 6000 classes.

TOLERANCES

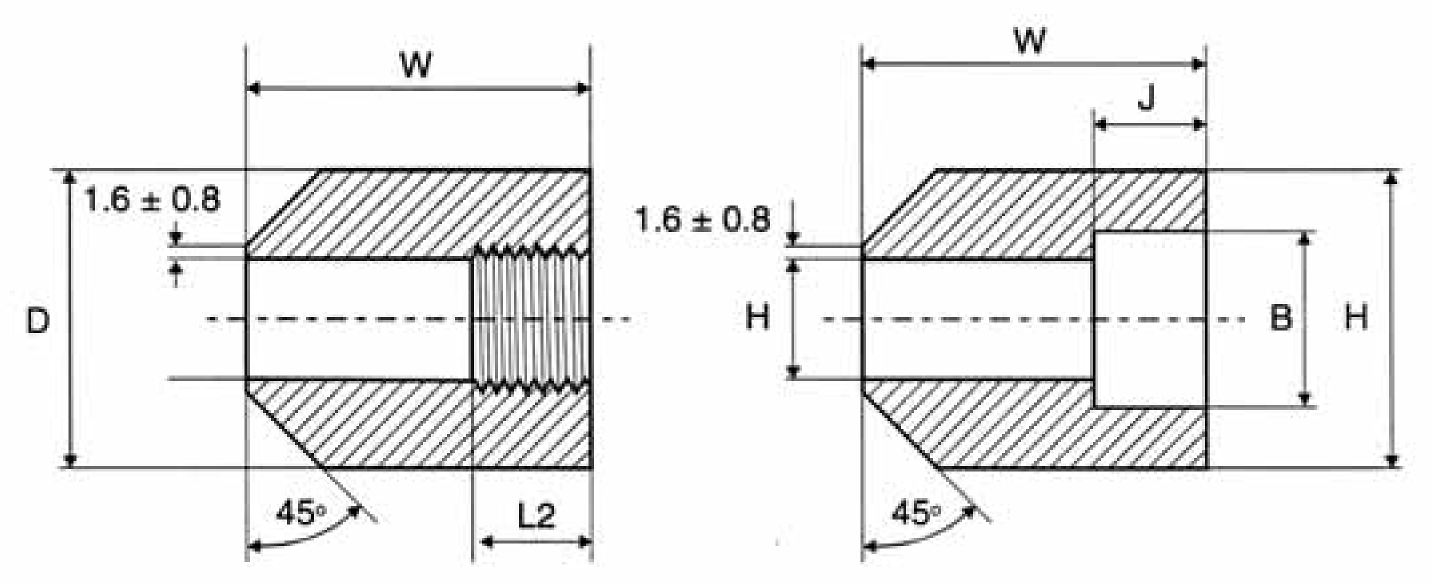
Laying length A-	Sizes 3/8" thru3/4"	+ 1.5 mm / - 0.0 mm
	Sizes 1" thru2"	+ 2.0 mm / - 0.0 mm
	Sizes 2-1/2" thru4"	+ 2.5 mm / - 0.0 mm
Laying length B-	Sizes 1/4" thru2"	± 0.25 mm
	Sizes 2-1/2" thru3"	+ 0.4 mm / - 0.25 mm

Bore D	-Sizes 1/4"	thru2"	± 0.8 mm
	-Sizes 2-1/2"	thru3"	± 1.5 mm
Shank Dia SD	-Sizes 3/8"	thru1-1/2"	± 0.50 mm
	-Sizes 2"	thru 3"	± 0.75 mm
	-Sizes 4"		± 0.75 mm
Shank Lg. SL	-Sizes 3/8"	thru3/4"	+ 0.0 mm/-1.5 mm
	-Sizes 1"	thru2"	+ 0.0 mm/-2.0 mm
	-Sizes 2-1/2"	thru4"	+ 0.0 mm/-2.5 mm



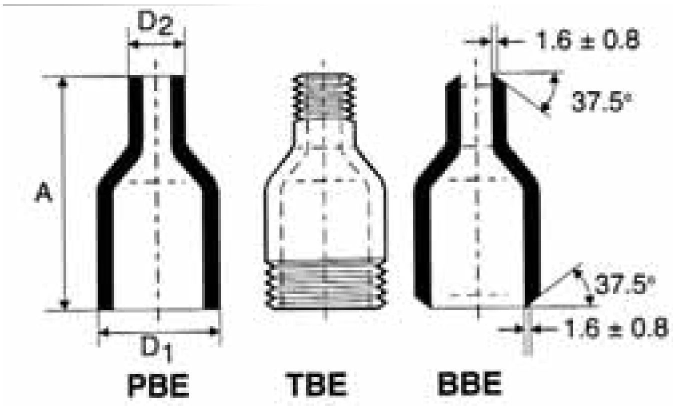
Dimensions in mm

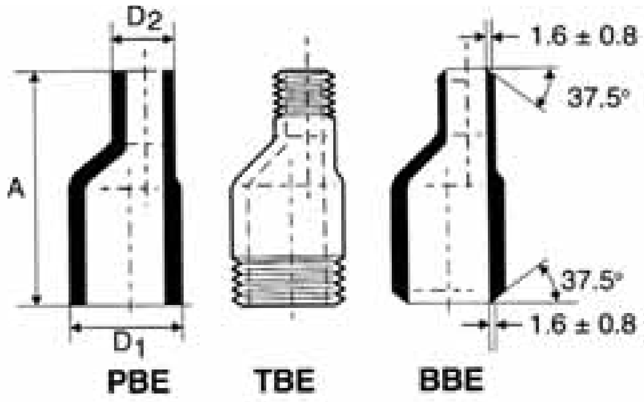
Nom. Pipe Size	Pipe End Min. A	Socket Bore Dia B	Socket Wall Min. C	Water Way Bore D	Laying Length E	Male Flange Min. F	Nut Min. G	Thrds Per 25.4 mm Max. H	Bearing Min. J	Depth of Socket Min. K	Length Assem. Nom. L	Clear Assem. Nut N
1/8	21.8	10.92 10.67	3.17	6.83 6.43	22.4 19.0	3.17	3.17	16	1.24	9.6	41.4	49.0
1/4	21.8	14.22 13.97	3.30	9.85 9.45	22.4 19.0	3.17	3.17	16	1.24	9.6	41.4	49.0
3/8	25.9	17.78 17.53	3.48	13.92 13.51	26.9 20.6	3.43	3.43	14	1.37	9.6	46.0	55.0
1/2	31.2	21.84 21.59	4.06	17.47 17.07	26.9 20.6	3.68	3.68	14	1.50	9.6	49.0	57.0
3/4	37.1	27.18 26.92	4.27	21.79 21.39	31.8 25.4	4.06	4.06	11	1.68	12.7	56.9	67.0
1	45.5	34.04 33.78	4.95	28.14 27.74	34.3 26.2	4.57	4.44	11	1.85	12.7	62.0	79.0
1-1/4	54.9	42.67 42.42	5.28	35.76 35.36	4.06 32.5	5.33	5.21	11	2.13	12.7	71.1	94.0
1-1/2	61.5	48.77 48.51	5.54 5.54	41.61 41.20	42.2 34.0	5.84	5.59	10	2.31	12.7	76.5	111.0
2	75.2	61.47 61.21	6.05	52.53 52.12	45.5 37.3	6.60	6.35	10	2.69	15.8	86.1	132.0
2-1/2	91.7	74.17 73.66	7.65	64.72 64.31	61.7 52.1	7.49	7.11	8	3.07	15.8	102.4	148.0
3	109.2	90.17 89.66	8.31	77.67 77.27	63.8 53.6	8.25	8.00	8	3.53	15.8	109.0	175.0



THREADED Dimensions in Millimeters			
Size (in)	D	W	L2 (Min)
3000Lbs			
1/4	22.1	39.9	10.0
3/8	25.9	50.0	10.5
1/2	34.0	50.0	13.5
3/4	39.1	50.0	14.0
1	48.0	50.0	17.5
1-1/4	59.9	50.0	18.0
1-1/2	65.0	50.0	18.5
2	80.0	59.9	19.0
6000Lbs			
1/4	25.9	39.9	10.0
3/8	36.0	50.0	10.5
1/2	43.9	50.0	13.5
3/4	50.0	50.0	14.0
1	59.9	50.0	17.5
1-1/4	65.0	50.0	18.0
1-1/2	80.0	50.0	18.5
2	95.0	59.9	19.0

SOCKET-WELDING Dimensions in Millimeters					
Size (in)	B	D	J (Min)	W	H
3000Lbs					
1/4	14.3	9.2	9.9	39.9	22.3
3/8	17.8	12.5	10.9	50.0	26.5
1/2	21.9	15.8	13.0	50.0	34.2
3/4	27.3	20.9	14.0	50.0	39.5
1	34.0	26.6	16.0	50.0	46.3
1-1/4	42.8	35.0	18.0	50.0	55.2
1-1/2	48.9	40.9	19.1	50.0	65.1
2	61.3	52.6	22.1	59.9	80.2
6000Lbs					
1/2	21.9	11.7	14.0	50.0	43.3
3/4	27.3	15.5	16.0	50.0	49.1
1	34.0	20.7	18.0	50.0	56.0
1-1/4	42.8	29.4	19.1	50.0	65.2
1-1/2	48.9	33.9	22.0	50.0	80.1
2	61.3	42.8	25.9	59.5	95.1





Concentric

Nominal Pipe Size (NPS)	Outside Diameter Large End D1	Outside Diameter Small End D2	End To End "A"
1/4 x 1/8	13.7	10.3	57
3/8 x 1/8	17.1	10.3	64
3/8 x 1/4	17.1	13.7	64
1/2 x 1/8	21.3	10.3	70
1/2 x 1/4	21.3	13.7	70
1/2 x 3/8	21.3	17.1	70
3/4 x 1/8	26.7	10.3	76
3/4 x 1/4	26.7	13.7	76
3/4 x 3/8	26.7	17.1	76
3/4 x 1/2	26.7	21.3	76
1 x 1/8	33.4	10.3	89
1 x 1/4	33.4	13.7	89
1 x 3/8	33.4	17.1	89
1 x 1/2	33.4	21.3	89
1 x 3/4	33.4	26.7	89
1-1/4 x 1/8	42.2	10.3	102
1 1/4 x 1/4	42.2	13.7	102
1-1/4 x 3/8	42.2	17.1	102
1-1/4 x 1/2	42.2	21.3	102
1-1/4 x 3/4	42.2	26.7	102
1-1/4 x 1	42.2	33.4	102
1-1/2 x 1/8	48.3	10.3	114
1-1/2 x 1/4	48.3	13.7	114
1-1/2 x 3/8	48.3	17.1	114
1-1/2 x 1/2	48.3	21.3	114
1-1/2 x 3/4	48.3	26.7	114
1-1/2 x 1	48.3	33.4	114
1-1/2 x 1-1/4	48.3	42.2	114

Eccentric

Dimensions in Millimeters

Nominal Pipe Size (NPS)	Outside Diameter Large End D1	Outside Diameter Small End D2	To End "A"
2 x 1/8	60.3	10.3	165
2 x 1/4	60.3	13.7	165
2 x 3/8	60.3	17.1	165
2 x 1/2	60.3	21.3	165
2 x 3/4	60.3	26.7	165
2 x 1	60.3	33.4	165
2 x 1-1/4	60.3	42.2	165
2 x 1-1/2	60.3	48.3	165
2-1/2 x 1/8	73.0	10.3	178
2-1/2 x 1/4	73.0	13.7	178
2-1/2 x 3/8	73.0	17.1	178
2-1/2 x 1/2	73.0	21.3	178
2-1/2 x 3/4	73.0	26.7	178
2-1/2 x 1	73.0	33.4	178
2-1/2 x 1-1/4	73.0	42.2	178
2-1/2 x 1-1/2	73.0	48.3	178
2-1/2 x 2	73.0	60.3	178
3 x 1/8	88.9	10.3	203
3 x 1/4	88.9	13.7	203
3 x 3/8	88.9	17.1	203
3 x 1/2	88.9	21.3	203
3 x 3/4	88.9	26.7	203
3 x 1	88.9	33.4	203
3 x 1-1/4	88.9	42.2	203
3 x 1-1/2	88.9	48.3	203
3 x 2	88.9	60.3	203
3 x 2-1/2	88.9	73.0	203
3-1/2 x 1/8	101.6	10.3	203

Dimensions in Millimeters

Concentric

Nominal Pipe Size (NPS)	Outside Diameter Large End D1	Outside Diameter Small End D2	End To End "A"
3-1/2 x 1/4	101,6	13,7	203
3-1/2 x 3/8	101,6	17,1	203
3-1/2 x 1/2	101,6	21,3	203
3-1/3 x 3/4	101,6	26,7	203
3-1/2 x 1	101,6	33,4	203
3-1/2 x 1-1/4	101,6	42,2	203
3-1/2 x 1-1/2	101,6	48,3	203
3-1/2 x 1	101,6	60,3	203
3-1/2 x 2-1/2	101,6	73,0	203
3-1/2 x 3	101,6	88,9	203
4 x 1/4	114,3	13,7	229

Eccentric

Nominal Pipe Size (NPS)	Outside Diameter Large End D1	Outside Diameter Small End D2	End To End "A"
4 x 3/8	114,3	17,1	229
4 x 1/2	114,3	21,3	229
4 x 3/4	114,3	26,7	229
4 x 1	114,3	33,4	229
4 x 1-1/4	114,3	42,2	229
4 x 1-1/2	114,3	48,3	229
4 x 2	114,3	60,3	229
4 x 2-1/2	114,3	73,0	229
4 x 3	114,3	88,9	229
4 x 3-1/2	114,3	101,6	229

PBE: PLAIN BOTH ENDS
PSE: PLAIN SMALL ENDS
PLE: PLAIN LARGE ENDS

BBE: BEVEL BOTH ENDS
BSE: BEVEL SMALL ENDS
BLE: BEVEL LARGE ENDS

TBE: THREAD BOTH ENDS
TSE: THREAD SMALL ENDS
TLE: THREAD LARGE ENDS

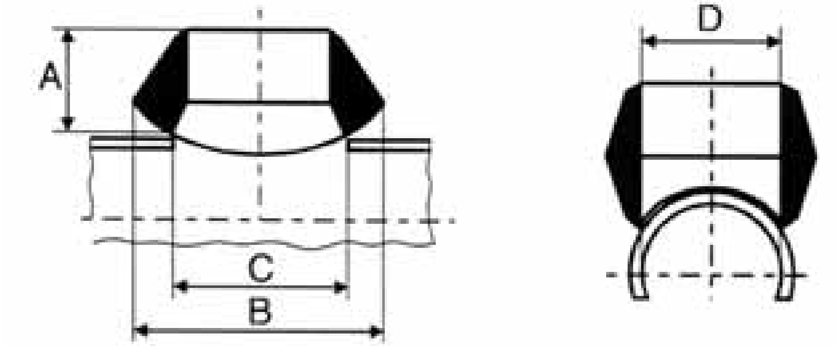
TOLERANCES

Nominal Pipe Size (NPS)	Overall length (mm)	Outside Diameter at End: Square Cut Ends (mm)	Outside Diameter at End: Other End Connections (mm)	Wall Thickness (see Note 1)
1/8 - 3/8	± 2	+ 0.40 - 0.80	± 0.80	Not less than 87.5% of nominal wall Thickness
1/2 - 1-1/2	± 2	+ 0.40 - 0.80	+ 1.50 - 0.80	
2 - 2-1/2	± 3	± 0.80	+ 1.50 - 0.80	
3 - 4	± 3	± 0.80	± 1.50	

Dimensions in Millimeters.
Note 1: Prior to threading or grooving

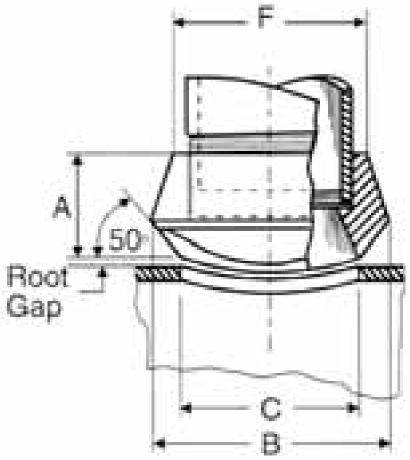
(Unit kg)

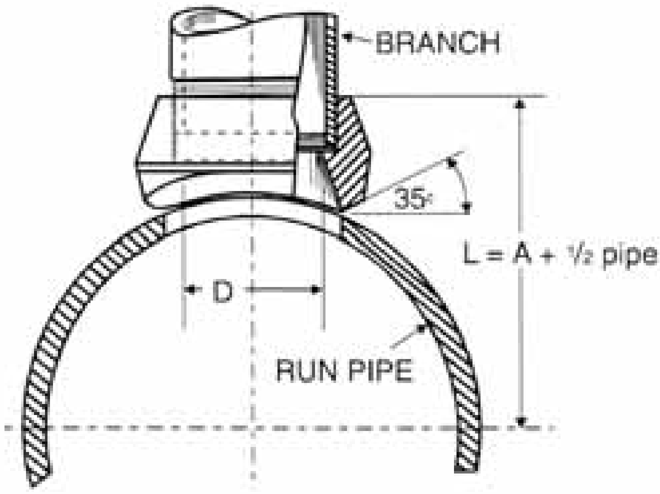
WEIGHT (KGS) SIZE	1/8"	1/4"	3/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"
2000LBS SCREWED												
90° ELBOW	0.10	0.08	0.13	0.22	0.32	0.47	0.74	0.93	1.53	2.98	4.54	10.21
45° ELBOW	0.08	0.06	0.10	0.20	0.27	0.41	0.64	0.75	1.19	3.46	5.44	8.9
TEE	0.13	0.12	0.15	0.31	0.43	0.61	0.95	1.25	1.93	4.11	6.12	14.74
3000LBS SCREWED												
90° ELBOW	0.10	0.14	0.27	0.41	0.72	1.03	1.31	2.21	2.47	4.53	7.77	13.27
45° ELBOW	0.08	0.12	0.24	0.34	0.54	0.92	0.97	1.84	1.93	3.46	5.44	8.96
TEE	0.13	0.13	0.38	0.56	0.84	1.70	1.95	3.18	3.63	6.24	9.53	17.24
COUPLING	0.05	0.05	0.06	0.13	0.19	0.39	0.68	0.99	1.37	2.07	3.08	5.44
HALF COUPLING	0.03	0.03	0.03	0.06	0.10	0.20	0.34	0.50	0.68	1.03	1.54	2.72
RED-COUPLING	0.05	0.05	0.06	0.13	0.19	0.39	0.68	0.99	1.37	2.07	3.08	5.44
CAP	0.04	0.04	0.05	0.11	0.18	0.35	0.60	0.70	1.06	1.84	2.65	4.57
STREET ELBOW	0.10	0.14	0.27	0.41	0.66	0.97	1.31	2.21	2.47			
UNION	0.28	0.28	0.28	0.31	0.46	0.67	1.03	1.51	2.43	3.48	5.25	12
6000 LBS SCREWED												
90° ELBOW	0.17	0.30	0.45	0.72	1.15	1.61	2.67	3.20	5.90	9.88	16.43	
45° ELBOW	0.11	0.27	0.39	0.61	1.02	1.17	2.67	2.61	4.37	7.01	14.16	
TEE	0.20	0.42	0.63	0.98	1.65	2.19	3.52	4.42	7.88	13.11	22.50	
COUPLING	0.08	0.06	0.18	0.31	0.41	0.85	1.05	1.87	3.40	4.20	6.10	10.04
HALF COUPLING	0.04	0.04	0.09	0.16	0.20	0.43	0.53	0.91	1.70	2.10	3.05	5.02
RED-COUPLING	0.08	0.06	0.18	0.31	0.41	0.85	1.05	1.81	3.40	4.20	6.10	10.04
CAP	0.06	0.06	0.09	0.14	0.20	0.34	0.59	0.77	1.47			
PLUGS & BUSHING 2000 / 3000 / 6000LBS												
SQUARE HEAD	0.01	0.01	0.03	0.05	0.09	0.16	0.27	0.38	0.63	0.96	1.53	3.83
HEX HEAD	0.01	0.03	0.05	0.07	0.14	0.25	0.47	0.62	1.10	1.73	2.15	5.90
ROUND HEAD	0.02	0.05	0.07	0.12	0.20	0.34	0.55	0.72	1.41	2.21	3.26	6.01
BUSHING		0.01	0.01	0.03	0.05	0.09	0.25	0.34	0.45	0.60	1.16	3.20
3000LBS SOCKET WELD												
90° ELBOW	0.09	0.10	0.10	0.22	0.31	0.53	0.72	0.97	1.71	3.80	5.50	10.95
45° ELBOW	0.07	0.06	0.09	0.20	0.26	0.40	0.64	0.77	1.22	3.57	5.10	9.41
TEE	0.11	0.09	0.15	0.32	0.42	0.65	0.99	1.35	2.07	3.90	5.90	14.20
COUPLING	0.04	0.05	0.07	0.13	0.19	0.27	0.49	0.59	0.97	1.42	1.88	3.31
HALF COUPLING	0.04	0.05	0.07	0.13	0.19	0.27	0.49	0.59	0.97	1.42	1.88	3.31
RED COUPLING	0.04	0.05	0.07	0.13	0.19	0.27	0.49	0.59	0.97	1.42	1.88	3.31
CAP	0.03	0.04	0.05	0.10	0.16	0.22	0.41	0.51	0.85	1.24	1.94	3.31
UNION	0.28	0.28	0.28	0.31	0.46	0.67	1.03	1.51	2.43	3.48	5.25	12
6000LBS SOCKET WELD												
90°ELBOW				0.40	0.63	1.19	1.36	2.41	2.72	4.75	8.55	14.31
45°ELBOW				0.30	0.57	0.88	1.11	2.01	2.15	4.05	6.02	11.17
TEE				0.54	0.88	1.44	1.85	3.27	3.60	6.94	10.61	16..92
COUPLING				0.24	0.33	0.65	0.75	1.20	2.12	2.86	4.01	6.35
HALF COUPLING				0.24	0.33	0.65	0.75	1.20	2.12	2.86	4.01	6.35
RED COUPLING				0.24	0.33	0.65	0.75	1.20	2.12	2.86	4.01	6.35
CAP				0.19	0.26	0.53	0.64	0.97	1.64	2.22	3.45	6.03



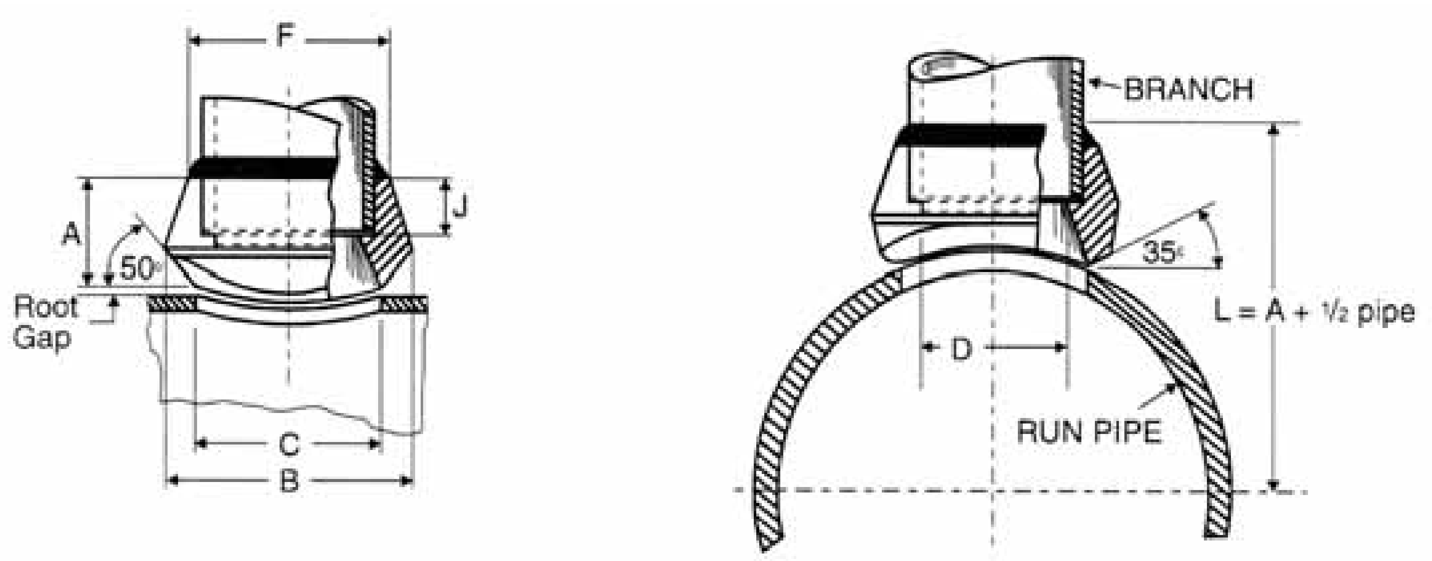
Outlet, full sizes and reducing sizes
Sch 40S, 80S, 160 and XXS

Outlet size in	Nominal run pipe size in	Dimensions A mm	B mm	C mm	D mm	Weight kg
Schedule 40S-80S						
1/8	3/8 to 36	14.3	25.4	15.9	-	0.04
1/4	3/8 to 36	14.3	5.4	15.9	-	0.04
3/8	1/2 to 36	19.1	31.8	19.1	-	0.07
1/2	1/2 to 36	19.1	34.9	23.8	15.9	0.07
3/4	3/4 to 36	22.2	41.3	30.2	20.6	0.11
1	1 to 36	27.0	50.8	36.5	26.2	0.18
1-1/4	1-1/4 to 36	31.8	60.3	44.5	34.9	0.32
1-1/2	1-1/2 to 36	33.3	73.0	50.8	41.3	0.36
2	2 to 36	38.1	88.9	65.1	52.4	0.68
2-1/2	2-1/2 to 36	41.3	103.2	76.2	61.9	1.02
3	3 to 36	44.5	122.2	93.7	77.8	1.70
4	4 to 36	50.8	152.4	120.7	101.6	3.04
5	5 to 36	54.0	181.0	147.6	128.6	3.8
6	6 to 36	60.3	215.9	169.9	154.0	5.58
8	8 to 36	69.9	263.5	220.7	201.6	9.53
10	10 to 36	77.8	319.1	274.6	254.0	15.88
12	12 to 36	85.7	377.8	325.8	304.8	26.30
Schedule 160-XXS						
1/2	1/2 to 24	28.6	34.9	14.3	-	0.11
3/4	3/4 to 24	31.8	44.5	19.1	-	0.32
1	1 to 24	38.1	50.8	25.4	-	0.38
1-1/4	1-1/4 to 24	44.5	61.9	33.3	-	0.57
1-1/2	1-1/2 to 24	50.8	69.9	38.1	-	0.79
2	2 to 24	55.6	81.0	42.9	-	0.97
2-1/2	2-1/2 to 24	61.9	96.8	54.0	-	1.53
3	3 to 24	73.0	120.7	73.0	-	2.87
4	4 to 24	84.1	152.4	98.4	-	4.76
5	5 to 24	93.7	187.3	122.2	-	6.46
6	6 to 24	104.8	220.7	146.1	-	12.70
8	8 to 24	111.1	284.2	173.0	-	20.41
10	10 to 24	136.5	342.9	215.9	-	39.46
12	12 to 24	158.8	422.3	257.2	-	62.14





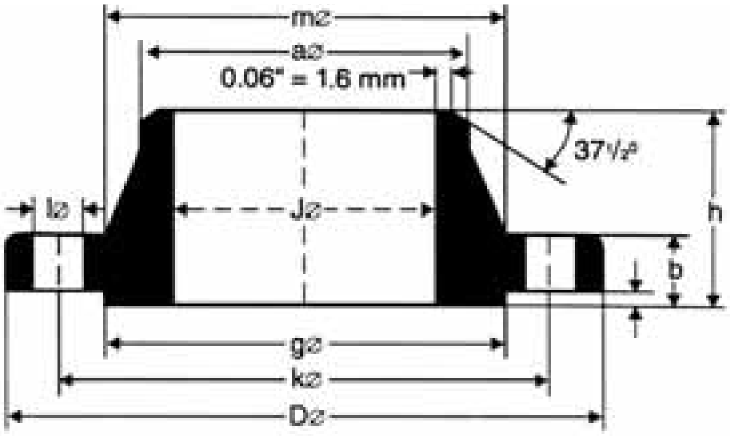
Run Pipe Size (in)		Out-Let Pipe NPS	A	B	C	F
3000Lb Standard and extra strong						
36-	3/8	1/8	19.1	25.4	15.9	17.3
	3/8	1/4	19.1	25.4	15.9	22.0
	1/2	3/8	20.6	31.8	19.1	25.8
	3/4	1/2	25.4	34.9	23.8	31.3
	1	3/4	26.9	44.5	30.2	37.1
	1-1/4	1	33.3	54.0	36.5	45.5
	1-1/2	1-1/4	33.3	65.1	44.5	54.9
	2	1-1/2	35.1	73.0	50.8	61.6
	2-1/2	2	38.1	88.9	65.1	75.3
	3	2-1/2	46.0	103.2	76.2	91.7
	4	3	50.8	122.4	93.7	109.1
	6	4	57.2	152.4	120.7	137.2
6000Lb Schedule 160 and double extra strong						
36-	3/4	1/2	31.8	44.5	19.1	33.9
	1	3/4	36.6	50.8	25.4	41.2
	1-1/4	1	39.6	61.9	33.3	49.9
	1-1/2	1-1/4	41.2	69.9	38.1	58.6
	2	1-1/2	42.9	82.6	49.2	66.7
	2-1/2	2	52.3	103.2	69.9	83.2



Dimensions in Millimeters.

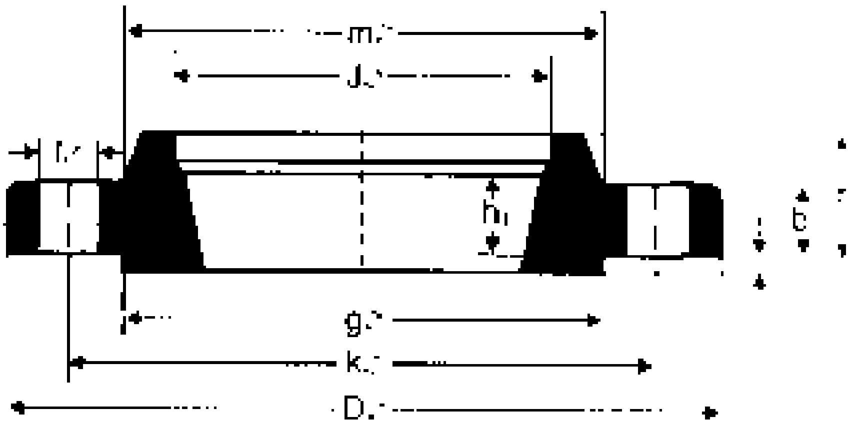
	Run Pipe Size (in)	Out-Let (Pipe NPS)	A	B	C	D	F	J
3000Lb Standard and extra strong								
36-	3/8	1/8	19.1	25.4	15.9	10.9	17.3	9.5
	3/8	1/4	19.1	25.4	15.9	14.4	22.0	9.5
	1/2	3/8	20.6	31.8	19.1	17.8	25.8	9.5
	3/4	1/2	25.4	34.9	23.8	22.0	31.3	11.1
	1	3/4	26.9	44.5	30.2	27.3	37.1	12.7
	1-1/4	1	33.3	54.0	36.5	34.1	45.5	13.5
	1-1/2	1-1/4	33.3	65.1	44.5	42.8	54.9	15.1
	2	1-1/2	35.1	73.1	50.8	48.9	61.6	15.9
	2-1/2	2	38.1	88.9	65.1	61.4	75.3	17.5
	3	2-1/2	39.6	103.2	76.2	74.2	91.7	23.8
	4	3	44.5	122.2	93.7	90.1	109.1	28.6
	6	4	47.8	152.4	120.7	115.8	137.2	29.4
6000Lb Schedule 160 and double extra strong								
36-	3/4	1/2	31.8	44.5	19.1	22.0	33.9	9.5
	1	3/4	36.6	50.8	25.4	27.3	41.2	14.3
	1-1/4	1	39.6	61.9	33.3	34.1	49.9	15.9
	1-1/2	1-1/4	41.2	69.9	38.1	42.8	58.6	20.6
	2	1-1/2	42.9	82.6	49.2	48.9	66.7	20.6
	2-1/2	2	52.3	103.2	58.7	61.4	83.2	22.2

ANSI B 16.5



D	Outside Diameter_	When OD is 24″ or less When OD is over 24″	±0.06″ ±0.12″	±1.6 mm ±3.2 mm
J	Inside Diameter	10″ and smaller 12″ to 18″ 20″ and larger	+0.03″ +0.06″ +0.12″ - 0.06″ +0.8 mm +1.6 mm +3.2 mm - 1.6 mm	
g	Diameter of Contact Face	0.03″ Raised Face 0.25″ Raised Face Tongue and Groove, Male and Female	±0.03″ ±0.02″ ±0.02″	±0.8 mm ±0.5 mm ±0.5 mm
a	Diameter of Hub at Point of Welding	5″ and smaller 6″ and larger	+0.09″ - 0.03″ +0.16″ - 0.03″ +2.4 mm - 0.8 mm +4.0 mm - 0.8 mm	
m	Diameter of Hub at Base_	When Hub Base is 24″ or less When OD is over 24″	±0.06″ ±0.12″	±1.6 mm ±3.2 mm
l	Drilling and Facing	Bolt Circle Diameter k±0.06″ Center-to-center of adjacent bolt holes Max. eccentricity between bolt cirlce dia.k and machined facing diameters: sizes 2-1/2″ and smaller sizes 3″ and larger	±1.6 mm ±0.03″ 0.03″ 0.06″	 ±0.8 mm 0.8 mm 1.6 mm
h	Overall Length of Hub	10″ and smaller 12″ and larger	±0.06″ ±0.12″	±1.6 mm ±3.2 mm
b	Thickness	18″ and smaller 20″ and larger	+0.12″ +0.19″	+3.2 mm +4.8 mm

1) This tolerance is not covered by ANSI B 16.5.

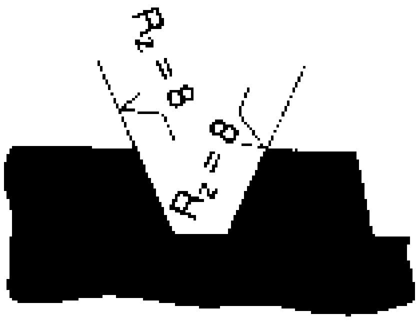


ANSI B 16.5

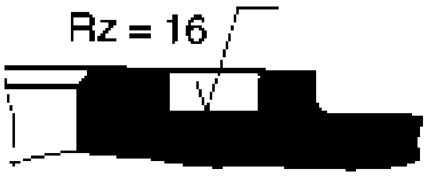
D	Outside Diameter_	When OD is 24″ or less When OD is over 24″	± 0.06″ ± 0.12″	±1,6 mm ±3.2 mm
$J_{1,2,3}$	Inside Diameter	Slip-on and Lap Joint 10″ and smaller 12″ and larger Threaded	+0.03″ +0.06″ Within limits on boring gauge	+0.8 mm +1.6 mm
Diameter of Counterbore g	Diameter of Contact Face	Same as for inside Diameter 0.03″ Raised Face 0.25″ Raised Face Tongue and Groove, Male and Female	±0.03″ ±0.02″ ±0.02″ not for flanges with ring joint	±0.8 mm ±0.5 mm ±0.5 mm
m	Outside Diameter of Hub 1)	12″ and smaller 14″ and larger	+0.09″ - 0.06″ ±0.12″ +2.4 mm - 1.6 mm ±3.2 mm	
l	Drilling and Facing	Bolt Circle Diameter k Center-to-center of adjacent bolt holes Max. eccentricity between bolt cirlce dia.k and machined facing diameters: sizes 2-1/2″ and smaller sizes 3″ and larger	±0.06″ ±0.03″ 0.03″ 0.06″	±1.6 mm ±0.8 mm 0.8 mm 1.6 mm
$L_{1,2,3}$	Overal Length of Hub	18″ and smaller 20″ and larger	+0.12″ - 0.03″ +0.19″ - 0.03″ +3.2 mm - 0.8 mm +4.8 mm - 1.6 mm	
b	Thickness	18″ and smaller 20″ and larger	+0.12″ +0.19″	+3.2 mm +4.8 mm

1) This tolerance is not covered by ANSI B 16.5.

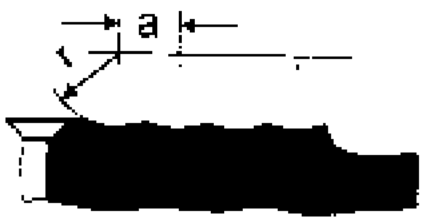
Ring Joint Facings



Tongue/Groove
Small Male/Female Facings



Stock Finiosh
Large Male/Female Facings



Facings in other designs on enquiry

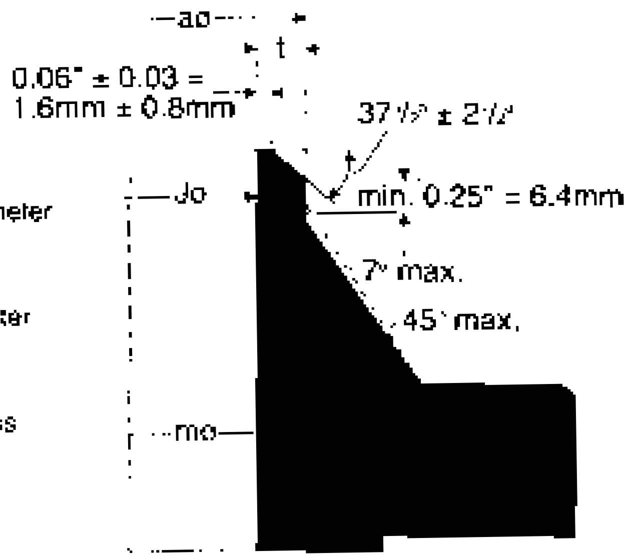
	≤ 12″ ≤ 300 mm	› 12″ › 300 mm
r (mm)	1.2 - 1.6	1.6 - 3.2
a (mm/U)	0.75 - 0.9	0.8 - 1.0)

Welding Ends
ANSI B 16.25

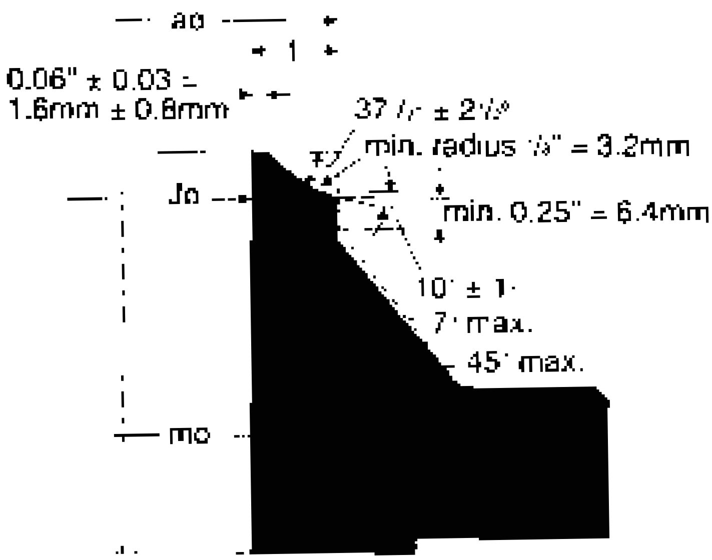
a = Outside diameter of pipe

i = Inside diameter of pipe

t = wall thickness of pipe



Bevel for Wall Thicknesses (t) 0.19" to 0.88 " inclusive



Bevel for Wall Thicknesses (t) greater than 0.88 "



WELDING NECK SLIP-ON

Pipe		Flange										
Nom. Size	O.D. in. mm	D in. mm	J in. mm	J1 in. mm	J2 in. mm	J3 in. mm	p in. mm	r in. mm	b in. mm	h in. mm	h1 in. mm	h2 in. mm
1/2″	0.84 21.3	3.50 88.9	*1 = Refer to ANSI B36-10 / B36-19 or as specified by purchaser (Bitte horizontal einfügen in Spalte J)	0.88 22.4	0.90 22.9	*2 = No counter bore required on 150lb threaded flanges (Bitte horizontal einfügen in Spalte J3)	0.38 9.7	0.12 3.0	0.44 11.2	1.88 47.8	0.62 15.7	0.62 15.7
3/4″	1.05 26.7	3.88 98.6		1.09 27.7	1.11 28.2		0.44 11.2	0.12 3.0	0.50 12.7	2.06 52.3	0.62 15.7	0.62 15.7
1″	1.315 33.4	4.25 108.0		1.36 34.5	1.38 35.1		0.50 12.7	0.12 3.0	0.56 14.2	2.19 55.6	0.69 17.5	0.69 17.5
1 1/4″	1.66 42.2	4.62 117.3		1.70 43.2	1.72 43.7		0.56 14.2	0.19 4.8	0.62 15.7	2.25 57.2	0.81 20.6	0.81 20.6
1 1/2″	1.90 48.3	5.00 127.0		1.95 49.5	1.97 50.0		0.62 15.7	0.25 6.4	0.69 17.5	2.44 62.0	0.88 22.4	0.88 22.4
2″	2.375 60.3	6.00 152.4		2.44 62.0	2.46 62.5		0.69 17.5	0.31 7.9	0.75 19.1	2.50 63.5	1.00 25.4	1.00 25.4
2 1/2″	2.875 73.0	7.00 177.8		2.94 74.7	2.97 75.4		0.75 19.1	0.31 7.9	0.88 22.4	2.75 69.9	1.42 28.4	1.42 28.4
3″	3.50 88.9	7.5 190.5		3.57 90.7	3.60 91.4		0.81 20.6	0.38 9.7	0.94 23.9	2.75 69.6	1.19 30.2	1.19 30.2
3 1/2″	4.00 101.6	8.50 215.9		4.07 103.4	4.10 104.1			0.38 9.7	0.94 23.9	2.81 71.4	1.25 31.8	1.25 31.8
4″	4.50 114.3	9.00 228.6		4.57 116.1	4.60 116.8			0.44 11.2	0.94 23.9	3.00 76.2	1.31 33.3	1.31 33.3
5″	5.563 141.3	10.00 254.0		5.66 143.8	5.69 144.5			0.44 11.2	0.94 23.9	3.50 88.9	1.44 36.6	1.44 36.6
6″	6.625 168.3	11.00 279.4		6.72 170.7	6.75 171.5			0.50 12.7	1.00 25.4	3.50 88.9	1.56 39.6	1.56 39.6
8″	8.625 219.1	13.50 342.9		8.72 221.5	8.75 222.3			0.50 12.7	1.12 28.4	4.00 101.6	1.75 44.5	1.75 44.5
10″	10.75 273	16.00 406.4		10.88 276.4	10.92 277.4			0.50 12.7	1.19 30.2	4.00 101.6	1.94 49.3	1.94 49.3
12″	12,75 323.8	19,00 482.6		12.88 327.2	12.92 328.2			0.50 12.7	1.25 31.8	4.50 114.3	2.19 55.6	2.19 55.6
14″	14.0 355.6	21.00 533.4		14.14 359.2	14.18 360.2			0.50 12.7	1.38 35.1	5.00 127.0	2.25 57.2	3.12 79.2
16″	16.0 406.4	23.50 596.9		16.16 410.5	16.19 411.2			0.50 12.7	1.44 36.6	5.00 127.0	2.50 62.5	3.44 87.4
18″	18.0 457.2	25.00 635.0		18.18 461.8	18.20 462.3			0.50 12.7	1.56 39.6	5.50 139.7	2.69 68.3	3.81 96.8
20″	20.0 508.0	27.5 698.5		20.20 513.1	20.25 514.4			0.50 12.7	1.69 42.9	5.69 144.5	2.88 73.2	4.06 103.1
24″	24.0 609.6	32.00 812.8		24.25 616.0	24.25 616.0			0.50 12.7	1.88 47.8	6.00 152.4	3.25 82.6	4.38 111.3

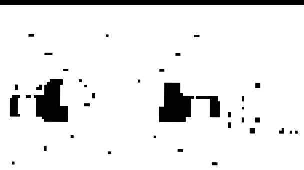
Note: Socket weld flanges up to 3″ in this presssure rating

Flanges 150lb/sq.in.

ANSI B16-5



BLIND

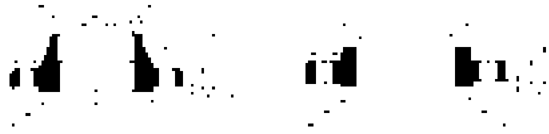


SOCKET WELD



THREADED

	Hub		Raised Face	Drilling Template			Approx Weight					
h3 in. mm	a in. mm	m in. mm	g in. mm	Number	l in. mm	k in. mm	W/N lbs kg	S/O lbs kg	L/J lbs kg	Blind lbs kg	S/W lbs kg	Thrd lbs kg
	0.84 21.3	1.19 30.2	1.38 35.1	4	0.62 15.7	2.38 60.5	1.1 0.48	0.9 0.39	0.8 0.38	0.9 0.42	0.9 0.42	0.9 0.39
	1.05 26.7	1.50 38.1	1.69 42.9	4	0.62 15.7	2.75 69.9	1.6 0.17	1.2 0.56	1.2 0.55	1.3 0.61	1.3 0.59	1.2 0.56
	1.32 33.5	1.94 49.3	2.00 50.8	4	0.62 15.7	3.12 79.2	2.2 1.01	1.7 0.78	1.7 0.76	1.9 0.86	1.8 0.81	1.7 0.78
	1.66 42.2	2.31 58.7	2.50 63.5	4	0.62 15.7	3.50 88.9	2.9 1.33	2.3 1.03	2.2 1.01	2.6 1.17	2.4 1.07	2.3 1.03
	1.90 48.3	2.56 65.0	2.88 73.2	4	0.62 15.7	3.88 98.6	3.8 1.72	2.9 1.32	2.9 1.30	3.4 1.53	3.0 1.36	2.9 1.32
	2.38 60.5	3.06 77.7	3.62 91.9	4	0.75 19.1	4.75 120.7	5.7 2.58	4.5 2.06	4.5 2.03	5.3 2.42	4.6 2.10	4.5 2.06
	2.88 73.2	3.56 90.4	4.12 104.6	4	0.75 19.1	5.50 139.7	9.1 4.11	7.2 3.28	7.2 3.25	8.7 3.94	7.3 3.90	7.2 3.28
	3.5 88.9	4.25 108.0	5.00 127.0	4	0.75 19.1	6.00 152.4	10.8 4.92	8.5 3.85	8.4 3.81	10.9 4.93	8.6 3.90	8.5 3.28
	4.00 101.6	4.81 122.2	5.50 139.7	8	0.75 19.1	7.00 177.8	13.4 6.08	10.6 4.81	10.5 4.76	13.6 6.17		10.6 4.81
	4.50 114.3	5.31 134.9	6.19 157.2	8	0.75 19.1	7.50 190.5	15.1 6.84	11.7 5.30	11.6 5.25	15.4 7.00		11.7 5.30
	5.56 141.2	6.44 163.6	7.31 185.7	8	0.88 22.4	8.50 215.9	18.9 8.56	13.4 6.07	13.3 6.02	19.9 8.63		13.4 6.07
	6.63 168.4	7.56 192.0	8.50 215.9	8	0.88 22.4	9.50 241.3	23.3 10.6	16.4 7.45	16.3 7.40	24.9 11.3		16.4 7.45
	8.63 219.2	9.69 246.1	10.62 269.7	8	0.88 22.4	11.75 298.5	38.8 17.6	26.7 12.1	26.7 12.1	43.2 19.6		26.7 12.1
	10.75 273.1	12.00 304.8	12.75 323.9	12	1.00 25.4	14.25 362.0	53.0 24.0	36.3 16.5	36.1 16.4	63.4 28.8		36.3 16.5
	12.75 323.9	14.38 365.3	15.00 381.0	12	1.00 25.4	17.00 431.8	80.4 36.5	57.7 26.2	57.5 26.1	95.2 43.2		57.7 26.2
	14.00 355.6	15.75 400.1	16.25 412.8	12	1.12 28.4	18.75 476.3	107 48.4	76.2 34.6	76.0 34.5	128.0 58.1		76.2 34.6
	16.00 406.4	18.00 457.2	18.50 469.9	16	1.12 28.4	21.25 539.8	134 60.6	98.7 44.8	98.2 44.6	167.0 76.0		98.7 44.8
	18.00 457.2	19.88 505.0	21.00 533.4	16	1.25 31.8	22.75 577.9	151 68.3	108.0 48.9	107.0 48.7	206.0 93.7		108.0 48.9
	20.00 508.0	22.00 558.8	23.00 584.2	20	1.25 31.8	25.00 635.0	186 84.5	136.0 61.9	136.0 61.6	269.0 122.0		136.0 61.9
	24.00 609.6	26.12 663.4	27.25 692.2	20	1.38 35.1	29.50 749.3	253 115	191.0 86.9	191.0 86.6	408.0 185.0		191.0 86.9

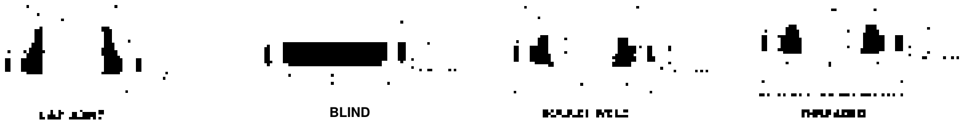


Pipe		Flange										
Nom. Size	O.D. in. mm	D in. m	J in. m	J1 in. mm	J2 in. mm	J3 in. mm	p in. mm	r in. mm	b in. mm	h in. mm	h1 in. mm	h2 in. mm
1/2″	0.84 21.3	3.75 95.2	*1 = Refer to ANSI B36-10 / B36-19 or as specified by purchaser (Bitte horizontal einfügen in Spalte J)	0.88 22.3	0.90 22.9	0.93 26.3	0.38 9.6	0.12 3.0	0.56 14.2	2.06 52.3	0.88 22.3	0.88 22.3
3/4″	1.05 26.7	4.62 117.3		1.09 27.7	1.11 28.2	1.14 29.0	0.44 11.1	0.12 3.0	0.62 15.7	2.25 57.1	1.00 25.4	1.00 25.4
1″	1.315 33.4	4.88 123.9		1.36 34.5	1.38 35.0	1.41 35.8	0.5 12.7	0.12 3.0	0.69 17.5	2.44 62.0	1.06 26.9	1.06 26.9
1 1/4″	1.66 42.2	5.25 133.3		1.70 43.2	1.72 43.7	1.75 44.4	0.56 14.2	0.19 4.8	0.75 19.0	2.56 65.0	1.06 26.9	1.06 26.9
1 1/2″	1.90 48.3	6.12 155.4		1.95 49.5	1.97 50.0	1.99 50.5	0.62 15.7	0.25 6.4	0.81 20.6	2.69 68.3	1.19 30.2	1.19 30.2
2″	2.375 60.3	6.50 165.1		2.44 62.0	2.46 62.5	2.50 63.5	0.69 17.5	0.31 7.8	0.88 22.3	2.75 69.8	1.31 33.2	1.31 33.2
2 1/2″	2.875 73.0	7.50 190.5		2.94 74.7	2.97 75.4	3.00 76.2	0.75 19.0	0.31 7.8	1.00 25.4	3.00 76.2	1.50 38.1	1.50 38.1
3″	3.50 88.9	8.25 209.5		3.57 90.7	3.60 91.4	3.63 92.2	0.81 20.5	0.38 9.6	1.12 28.4	3.12 79.2	1.69 42.9	1.69 42.9
3 1/2″	4.00 101.6	9.00 228.6		4.07 103.4	4.10 104.1	4.13 104.9		0.38 9.6	1.19 30.2	3.19 81.0	1.75 44.4	1.75 44.4
4″	4.50 114.3	10.00 254.0		4.57 116.1	4.60 116.8	4.63 117.6		0.44 11.1	1.25 31.7	3.38 85.8	1.88 47.7	1.88 47.7
5″	5.563 141.3	11.00 279.4		5.66 143.8	5.69 144.5	5.69 144.5		0.44 11.1	1.38 35.0	3.88 98.5	2.00 50.8	2.00 50.8
6″	6.625 168.3	12.50 317.5		6.72 170.7	6.75 171.4	6.75 171.4		0.50 12.7	1.44 36.5	3.88 98.5	2.06 52.3	2.06 52.3
8″	8.625 219.1	15.00 381.0		8.72 221.5	8.75 222.2	8.75 222.2		0.50 12.7	1.62 41.1	4.38 111.2	2.44 61.9	2.44 61.9
10″	10.75 273	17.50 444.5		10.88 276.3	10.92 277.4	10.88 276.3		0.50 12.7	1.88 47.7	4.62 117.3	2.62 66.5	3.75 95.2
12″	12.75 323.8	20.50 520.7		12.88 327.1	12.92 328.2	12.94 328.7		0.50 12.7	2.00 50.8	5.12 130.0	2.88 73.1	4.00 101.6
14″	14.0 355.6	23.00 584.2		14.14 359.1	14.18 360.2	14.19 360.4		0.50 12.7	2.12 53.8	5.62 142.7	3.00 76.2	4.38 111.2
16″	16.0 406.4	25.50 647.7		16.16 410.5	16.19 411.2	16.19 411.2		0.50 12.7	2.25 57.1	5.75 146.0	3.25 82.5	4.75 120.6
18″	18.0 457.2	28.00 711.2		18.18 461.8	18.20 462.3	18.19 462.0		0.50 12.7	2.38 60.4	6.25 158.7	3.50 88.9	5.12 130.6
20″	20.0 508.0	30.50 774.7		20.20 513.1	20.25 514.3	20.19 512.8		0.50 12.7	2.50 63.5	6.38 162.0	3.75 95.2	5.50 139.7
24″	24.0 609.6	36.00 914.4		24.25 615.9	24.25 615.9	24.19 614.4		0.50 12.7	2.75 69.8	6.62 168.1	4.19 106.4	6.00 152.4

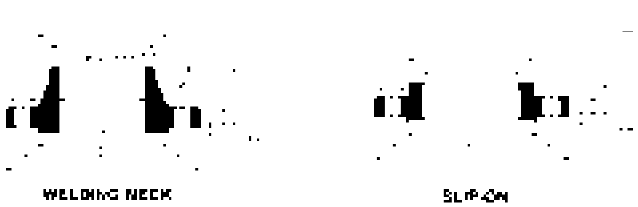
Note: Socket weld flanges up to 3″ in this presssure rating

Flanges 300lb/sq.in.

ANSI B16-5



h3 in. mm	Hub a in. mm	Hub m in. mm	Raised Face g in. mm	Drilling Template Num ber	Drilling Template l in. mm	Drilling Template k in. mm	Approx Weight W/N lbs kg	Approx Weight S/O lbs kg	Approx Weight L/J lbs kg	Approx Weight Blind lbs kg	Approx Weight S/W lbs kg	Approx Weight Thrd lbs kg
0.62 15.7	0.84 21.3	1.50 38.1	1.38 35.0	4	0.62 15.7	2.62 66.5	1.7 0.75	1.4 0.64	1.4 0.62	1.40 0.64	1.50 0.66	1.40 0.64
0.62 15.7	1.05 26.7	1.88 47.7	1.69 42.9	4	0.75 19.0	3.25 82.5	2.8 1.26	2.5 1.12	2.4 1.10	2.40 1.11	2.50 1.15	2.50 1.12
0.69 17.5	1.32 33.5	2.12 53.8	2.00 50.8	4	0.75 19.0	3.50 88.9	3.5 1.52	3.0 1.36	2.9 1.33	3.10 1.39	3.10 1.40	3.00 1.36
0.81 20.5	1.66 42.2	2.50 63.5	2.50 63.5	4	0.75 19.0	3.88 98.5	4.5 2.03	3.7 1.68	3.6 1.65	3.90 1.79	3.90 1.75	3.70 1.68
0.88 22.3	1.90 48.3	2.75 69.8	2.88 73.1	4	0.88 22.3	4.50 114.3	6.4 2.89	5.5 2.49	5.4 2.44	5.90 2.66	5.60 2.55	5.50 2.49
1.12 28.4	2.38 60.4	3.31 84.0	3.62 91.9	8	0.75 19.0	5.00 127.0	7.5 3.40	6.3 2.87	6.2 2.83	7.00 3.18	6.5 2.93	6.30 2.87
1.25 31.7	2.88 73.1	3.94 100.0	4.12 104.6	8	0.88 22.3	5.88 149.3	11.4 5.17	9.5 4.32	9.4 4.25	10.70 4.85	9.70 4.40	9.50 4.32
1.25 31.7	3.50 88.9	4.62 117.3	5.00 127.0	8	0.88 22.3	6.62 168.1	15.3 6.93	12.9 5.85	12.7 5.78	15.0 6.81	13.0 3.92	12.90 5.85
1.44 36.5	4.00 101.6	5.25 133.3	5.50 139.7	8	0.88 22.3	7.25 184.1	19.1 8.67	16.2 7.34	16.0 7.27	19.2 8.71		16.20 7.34
1.44 36.5	4.50 114.3	5.75 146.0	6.19 157.2	8	0.88 22.3	7.88 200.1	24.7 11.2	21.2 9.61	21.0 9.55	25.3 11.5		21.20 9.61
1.69 42.9	5.56 141.2	7.00 177.8	7.31 185.6	8	0.88 22.3	9.25 234.9	33.3 15.1	27.1 12.3	26.9 12.2	34.4 15.6		27.10 12.30
1.81 45.9	6.63 168.4	8.12 206.2	8.50 215.9	12	0.88 22.3	10.62 269.7	42.4 19.1	34.4 15.6	34.1 15.5	46.0 20.9		34.40 15.60
2.00 50.8	8.63 219.2	10.25 260.3	10.62 269.7	12	1.00 25.4	13.00 330.2	65.9 29.9	53.3 24.2	53.1 24.1	75.6 34.3		53.30 24.20
2.19 55.6	10.75 273	12.62 320.5	12.75 323.8	16	1.12 28.4	15.25 387.3	94.1 42.7	75.1 34.1	75.8 34.4	117.0 53.3		75.10 34.10
2.38 60.4	12.75 323.8	14.75 374.6	15.00 381.0	16	1.25 31.7	17.75 450.8	136 61.8	110.0 49.8	111.0 50.4	174.0 78.8		110.00 49.80
2.50 63.5	14.00 355.6	16.75 425.4	16.25 412.7	20	1.25 31.7	20.25 514.3	189 85.8	154.0 69.9	156.0 70.9	231.0 105.0		154.00 69.9
2.69 68.3	16.00 406.4	19.00 482.6	18.50 469.9	20	1.38 35.0	22.5 571.5	234 106	194.0 88.1	197.0 89.5	302.0 137.0		194.00 88.10
2.75 69.8	18.00 457.2	21.00 533.4	21.00 533.4	24	1.38 35.0	24.75 628.6	289 131	240.0 109.0	245.0 111.0	386.0 175.0		240.0 109.0
2.88 73.1	20.00 508	23.12 587.2	23.00 584.2	24	1.38 35.0	27.00 685.8	348 158	295.0 134.0	302.0 137.0	487.0 221.0		295.0 134.0
3.25 82.5	24.00 609.6	27.62 701.5	27.25 692.1	24	1.62 41.1	32.00 812.8	507 230	443.0 201.0	449.0 204.0	747.0 339.0		443.0 201.0



USE 600LB DIMENSIONS FOR THE SIZES

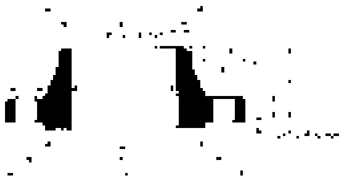
Pipe		Flange										
Nom. Size	O.D. in. mm	D in. mm	J in. mm	J1 in. mm	J2 in. mm	J3 in. mm	p in. mm	r in. mm	b in. mm	h in. mm	h1 in. mm	h2 in. mm
1/2″	0.84 21.3											
3/4″	1.05 26.7											
1″	1.315 33.4											
1 1/4″	1.66 42.2											
1 1/2″	1.90 48.3											
2″	2.375 60.3											
2 1/2″	2.875 73.0											
3″	3.50 88.9											
3 1/2″	4.00 101.6											
4″	4.50 114.3	10.00 254.0		4.57 116.1	4.60 116.8	4.63 117.6		0.44 11.2	1.38 35.1	3.50 88.9	2.00 50.8	2.00 50.8
5″	5.563 141.3	11.00 279.4		5.66 143.8	5.69 144.5	5.69 144.5		0.44 11.2	1.50 38.1	4.00 101.6	2.12 53.8	2.12 53.8
6″	6.625 168.3	12.50 317.5		6.72 170.7	6.75 171.5	6.75 171.5		0.50 12.7	1.62 41.1	4.06 103.1	2.25 57.2	2.25 57.2
8″	8.625 219.1	15.00 381.0		8.72 221.5	8.75 222.3	8.75 222.3		0.50 12.7	1.88 47.8	4.62 117.3	2.69 68.3	2.69 68.3
10″	10.75 273	17.50 444.5		10.88 276.4	10.92 277.4	10.88 276.4		0.50 12.7	2.12 53.8	4.88 124.0	2.88 73.2	4.00 101.6
12″	12.75 323.8	20.50 520.7		12.88 327.2	12.92 328.2	12.94 328.7		0.50 12.7	2.25 57.2	5.38 136.7	3.12 79.2	4.25 108.0
14″	14.0 355.6	23.00 584.2		14.14 359.2	14.18 360.2	14.19 360.4		0.50 12.7	2.38 60.5	5.88 149.4	3.31 84.1	4.62 117.3
16″	16.0 406.4	25.50 647.7		16.16 410.5	16.19 411.2	16.19 411.2		0.50 12.7	2.50 63.5	6.00 152.4	3.69 93.7	5.00 127.0
18″	18.0 457.2	28.00 711.2		18.18 461.8	18.2 462.3	18.19 462.0		0.50 12.7	2.62 66.5	6.50 165.1	3.88 98.6	5.38 136.7
20″	20.0 508.0	30.50 774.7		20.20 513.1	20.25 514.4	20.19 512.8		0.50 12.7	2.75 69.9	6.62 168.1	4.00 101.6	5.75 146.1
24″	24.0 609.6	36.00 914.4		24.25 616.0	24.25 616.0	24.19 614.4		0.50 12.7	3.00 76.2	6.88 174.8	4.50 114.3	6.25 158.8

Note: Socket weld flanges are not available in this pressure rating.

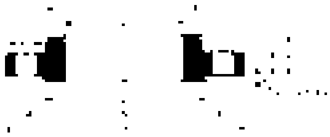


LAP JOINT BLIND SOCKET WELD THREADED

h in. mm	Hub a in. mm	Hub m in. mm	Raised Face g in. mm	Drilling Template Number	Drilling Template l in. mm	Drilling Template k in. mm	Approx Weight W/N lbs kg	Approx Weight S/O lbs kg	Approx Weight L/J lbs kg	Approx Weight Blind lbs kg	Approx Weight S/W lbs kg	Approx Weight Thrd lbs kg
USE 600LB DIMENSIONS FOR THESE SIZES												
1.44 36.6	4.50 114.3	5.75 146.1	6.19 157.2	8	1.00 25.4	7.88 200.2	28.2 12.8	24.4 11.1	24.0 10.9	30.2 13.7		24.4 11.1
1.69 42.9	5.56 141.2	7.00 177.8	7.31 185.7	8	1.00 25.4	9.25 235.0	37.2 16.9	30.6 13.9	30.2 13.7	40.7 18.5		30.6 13.7
1.81 46.0	6.63 168.4	8.12 206.2	8.50 215.9	12	1.00 25.4	10.62 269.7	48.5 22.0	40.3 18.3	39.6 18.0	56.2 25.5		40.3 18.3
2.00 50.8	8.63 219.2	10.25 260.4	10.62 269.7	12	1.12 28.4	13.00 330.2	76.4 34.7	63.0 28.6	62.3 28.3	93.8 42.6		63.0 28.6
2.19 55.6	10.75 273.1	12.62 320.5	12.75 323.9	16	1.25 31.8	15.25 387.4	107 48.5	86.3 39.2	85.5 38.8	142 64.5		86.3 39.2
2.38 60.5	12.75 323.9	14.75 374.7	15.00 381.0	16	1.38 35.1	17.75 450.9	153 69.6	126 57.0	125 56.6	208 94.3		126 57.0
2.50 63.5	14.00 355.6	16.75 425.5	16.25 412.8	20	1.38 35.1	20.25 514.4	210 95.5	174 79.1	173 78.6	273 124		174 79.1
2.69 68.3	16.00 406.4	19.00 482.6	18.50 469.9	20	1.50 38.1	22.50 571.5	260 118	223 101	220 100	357 162		223 101
2.75 69.9	18.00 457.2	21.00 533.4	21.00 533.4	24	1.50 38.1	24.75 628.7	319 145	271 123	269 122	452 205		271 123
2.88 73.2	20.00 508.0	23.12 587.2	23.00 584.2	24	1.62 41.1	27.00 685.8	381 173	322 146	319 145	560 254		322 146
3.25 82.6	24.00 609.6	27.62 701.5	27.25 692.2	24	1.88 47.8	32.00 812.8	549 249	482 219	478 217	850 386		482 219



WELDING NECK



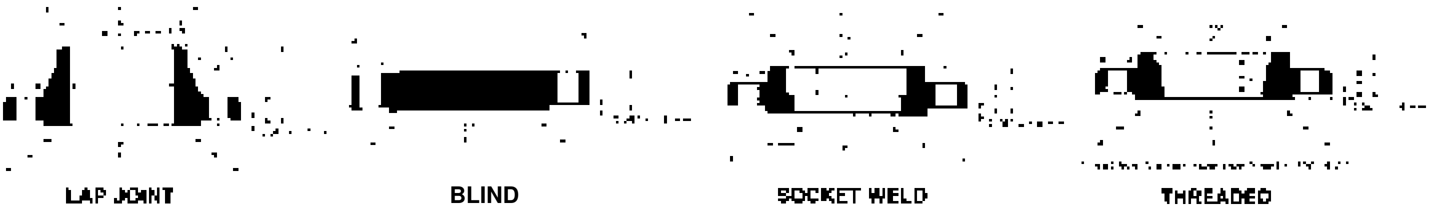
SLIP-ON

Pipe		Flange										
Nom. Size	O.D. in. mm	D in. mm	J in. mm	J1 in. mm	J2 in. mm	J3 in. mm	p in. mm	r in. mm	b in. mm	h in. mm	h1 in. mm	h in. mm
1/2"	0.84 21.3	3.75 95.3	*1 = Refer to ANSI B36-10 / B36-19 or as specified by purchaser (Bitte horizontal einfügen in Spalte J)	0.88 22.4	0.90 22.9	0.93 23.6	0.38 9,60	0.12 3.0	0.56 14.2	2.06 52.3	0.88 22.4	0.88 22.4
3/4"	1.05 26.7	4.62 117.3		1.09 27.7	1.11 28.2	1.14 29.0	0.44 11.11	0.12 3.0	0.62 15.7	2.25 57.2	1.00 25.4	1.00 25.4
1"	1.315 33.4	4.88 124.0		1.36 34.5	1.38 35.1	1.41 35.8	0.50 12.7	0.12 3.0	0.69 17.5	2.44 62.0	1.06 26.9	1.06 26.9
1 1/4"	1.66 42.2	5.25 133.4		1.70 43.2	1.72 43.7	1.75 44.5	0.56 14.2	0.19 4.8	0.81 20.6	2.62 66.5	1.12 28.4	1.12 28.4
1 1/2"	1.90 48.3	6.12 155.4		1.95 49.5	1.97 50.0	1.99 50.5	0.62 15.7	0.25 6.4	0.88 22.4	2.75 69.9	1.25 31.8	1.25 31.8
2"	2.375 60.3	6.50 165.1		2.44 62.0	2.46 62.5	2.50 63.5	0.69 17.5	0.31 7.9	1.00 25.4	2.88 73.2	1.44 36.6	1.44 36.6
2 1/2"	2.875 73.0	7.50 190.5		2.94 74.7	2.97 75.4	3.00 76.2	0.75 19.0	0.31 7.9	1.12 28.4	3.12 79.2	1.62 41.1	1.62 41.1
3"	3.50 88.9	8.25 209.6		3.57 90.7	3.60 91.4	3.63 92.2	0.81 20.6	0.38 9.7	1.25 31.8	3.25 82.6	1.81 46.0	1.81 46.0
3 1/2"	4.00 101.6	9.00 228.6		4.07 103.4	4.10 104.1	4.13 104.9		0.38 9.7	1.38 35.1	3.38 85.9	1.94 49.3	1.94 49.3
4"	4.50 114.3	10.75 273.1		4.57 116.1	4.60 116.8	4.63 117.6		0.44 11.2	1.50 38.1	4.00 101.6	2.12 53.8	2.12 53.8
5"	5.563 141.3	13.00 330.2		5.66 143.8	5.69 144.5	5.69 144.5		0.44 11.2	1.75 44.5	4.50 114.3	2.38 60.5	2.38 60.5
6"	6.625 168.3	14.00 355.6		6.72 170.7	6.75 171.5	6.75 171.5		0.50 12.7	1.88 47.8	4.62 117.3	2.62 66.5	2.62 66.5
8"	8.625 219.1	16.50 419.1		8.72 221.8	8.75 222.3	8.75 222.3		0.50 12.7	2.19 55.6	5.25 133.4	3.00 76.2	3.00 76.2
10"	10.75 273	20.00 508.0		10.88 276.4	10.92 277.4	10.88 276.4		0.50 12.7	2.50 63.5	6.00 152.4	3.38 85.9	4.38 111.3
12"	12.75 323.8	22.00 558.8		12.88 327.2	12.92 328.2	12.94 328.7		0.50 12.7	2.62 66.5	6.12 155.4	3.62 91.9	4.62 117.3
14"	14.0 355.6	23.75 603.3		14.14 359.2	14.18 360.2	14.19 360.4		0.50 12.7	2.75 69.9	6.50 165.1	3.69 93.7	5.00 127.0
16"	16.0 406.4	27.00 685.8		16.16 410.5	16.19 411.2	16.19 411.2		0.50 12.7	3.00 76.2	7.00 177.8	4.19 106.4	5.50 139.7
18"	18.0 457.2	29.25 743.0		18.18 461.8	18.20 462.3	18.19 462.0		0.50 12.7	3.25 82.6	7.25 184.2	4.62 117.3	6.00 152.4
20"	20.0 508.0	32.00 812.8		20.20 513.1	20.25 514.4	20.19 512.8		0.50 12.7	3.50 88.9	7.50 190.5	5.00 127.0	6.50 165.1
24"	24.0 609.6	37.00 939.8		24.25 616.0	24.25 616.0	24.19 614.4		0.50 12.7	4.00 101.6	8.00 203.2	5.50 139.7	7.25 184.2

Note: Socket weld flanges up to 3" in this presssure rating

Flanges 600 lb/sq.in.

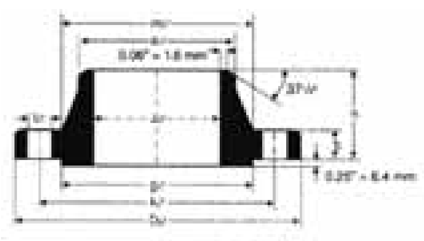
ANSI B 16-5



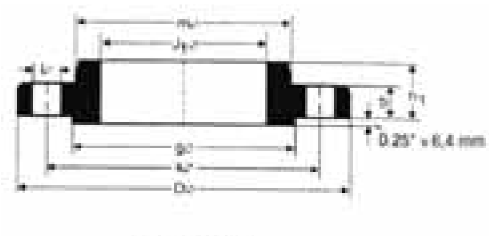
	Hub		Raised Face	Drilling Template			Approx. Weight					
h in. mm	a in. mm	m in. mm	g in. mm	Num- ber	l in. mm	k in. mm	W/N lbs kg	S/O lbs kg	L/J lbs kg	Blind lbs kg	S/W lbs kg	Thrd lbs kg
0.62 15.7	0.84 21.3	1.50 38.1	1.38 35.1	4	0.62 15.7	2.62 66.5	1.9 0.87	1.6 0.74	1.6 0.72	1.7 0.76	1.7 0.76	1.6 0.74
0.62 15.7	1.05 26.7	1.88 47.8	1.69 42.9	4	0.75 19.1	3.25 82.6	3.2 1.45	2.8 1.27	2.8 1.25	2.8 1.28	2.8 1.29	2.8 1.27
0.69 17.5	1.32 33.5	2.12 53.8	2.00 50.8	4	0.75 19.1	3.50 88.9	3.9 1.76	3.3 1.52	3.3 1.50	3.5 1.60	3.4 1.55	3.3 1.52
0.81 20.6	1.66 42.2	2.50 63.5	2.50 63.5	4	0.75 19.1	3.88 98.6	5.5 2.49	4.5 2.03	4.4 2.00	4.9 2.23	4.5 2.06	4.5 2.03
0.88 22.4	1.90 48.3	2.75 69.9	2.88 73.2	4	0.88 22.4	4.50 114.3	7.7 3.49	6.5 2.96	6.4 2.92	7.2 3.25	6.60 3.00	6.5 2.96
1.12 28.4	2.38 60.5	3.31 84.1	3.62 91.9	8	0.75 19.1	5.00 127.0	9.6 4.36	8.0 3.62	7.8 3.55	9.1 4.15	8.1 3.67	8.0 3.62
1.25 31.8	2.88 73.2	3.94 100.1	4.12 104.6	8	0.88 22.4	5.88 149.4	14.2 6.43	11.6 5.28	11.5 5.23	13.5 6.13	11.8 5.35	11.6 5.28
1.38 35.1	3.50 88.9	4.62 117.3	5.00 127.0	8	0.88 22.4	6.60 168.1	18.8 8.53	15.4 7.00	15.3 6.95	18.6 8.44	15.6 7.06	15.4 7.00
1.56 39.6	4.00 101.6	5.25 133.4	5.50 139.7	8	1.00 25.4	7.25 184.2	23.6 10.7	19.5 8.84	19.3 8.78	24.2 11.0		19.5 8.84
1.62 41.1	4.50 114.3	6.00 152.4	6.19 157.2	8	1.00 25.4	8.50 215.9	38.3 17.4	31.9 14.5	31.7 14.4	38.1 17.3		31.9 14.5
1.88 47.8	5.56 141.2	7.44 189.0	7.31 185.7	8	1.12 28.4	10.50 266.7	64.3 29.2	53.7 24.4	53.5 24.3	64.8 29.4		53.7 24.4
2.00 50.8	6.63 168.4	8.75 222.3	8.50 215.9	12	1.12 28.4	11.50 292.1	76.9 34.9	63.2 28.7	62.8 28.5	79.5 36.1		63.2 28.7
2.25 57.2	8.63 219.2	10.75 273.1	10.62 269.7	12	1.25 31.8	13.75 349.3	119 53.9	95.6 43.4	94.9 43.1	130 58.9		95.6 43.4
2.56 65.0	10.75 273.1	13.50 342.9	12.75 323.9	16	1.38 35.1	17.00 431.8	191 86.5	155 70.3	155 70.5	215 97.5		155 70.3
2.75 69.9	12.75 323.9	15.75 400.1	15.00 381.0	20	1.38 35.1	19.25 489.0	227 103	186 84.2	190 86.1	273 124		186 84.2
2.88 73.2	14.00 355.6	17.00 431.8	16.25 412.8	20	1.50 38.1	20.75 527.1	269 122	217 98.7	220 100	333 151		217 98.7
3.06 77.7	16.00 406.4	19.50 495.3	18.50 469.9	20	1.62 41.1	23.75 603.3	374 170	313 142	319 145	471 214		313 142
3.12 79.2	18.00 457.2	21.50 546.1	21.00 533.4	20	1.75 44.5	25.75 654.1	449 204	381 173	390 177	599 272		381 173
3.25 82.6	20.00 508.0	24.00 609.6	23.00 584.2	24	1.75 44.5	28.50 723.9	560 254	485 220	496 225	769 349		485 220
3.62 91.9	24.00 609.6	28.25 717.6	27.25 692.2	24	2.00 50.8	33.00 838.2	789 358	687 312	700 318	1174 533		687 312

Flanges 900 lb/sq.in.

ANSI B16-5



WELDING NECK



SLIP-ON

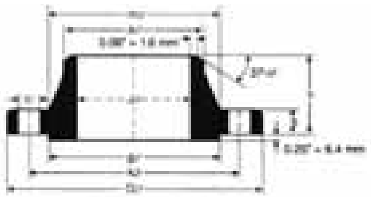
Pipe		Flange										
Nom. Size	OD in. mm	D in. mm	J in. mm	J1 in. mm	J2 in. mm	J3 in. mm	p in. mm	r in. mm	b in. mm	h in. mm	h1 in. mm	h2 in. mm
1/2"	0.84 21.3		Refer to ANSI B36-10/ B36-19 or as specified by purchaser									
3/4"	1.05 26.7											
1"	1.315 33.4											
1.1/4"	1.66 42.2				USE 1500LB DIMENSIONS FOR THESE SIZES							
1.1/2"	1.90 48.3											
2"	2.375 60.3											
2.1/2"	2.875 73.0											
3"	3.50 88.9	9.50 241.3		3.57 90.7	3.60 91.4	3.63 92.2		0.38 9.6	1.50 38.1	4.00 101.6	2.12 53.8	2.12 53.8
4"	4.50 114.3	11.50 292.1		4.57 116.1	4.66 116.8	4.63 117.6		0.44 11.1	1.75 44.4	4.50 114.3	2.75 69.8	2.75 69.8
5"	5.563 141.3	12.75 349.2		5.66 143.8	5.69 144.5	5.63 144.5		0.44 11.1	2.00 50.8	5.00 127.0	3.12 79.2	3.12 79.2
6"	6.625 168.3	15.00 381.0		6.72 170.7	6.75 171.4	6.75 171.4		0.50 12.7	2.19 55.6	5.50 139.7	3.38 85.8	3.38 85.8
8"	8.625 219.1	18.50 469.9		8.72 221.5	8.75 222.2	8.75 222.2		0.50 12.7	2.50 63.5	6.38 162.0	4.00 101.6	4.50 114.3
10"	10.75 273	21.50 546.1		10.88 276.3	10.92 277.4	10.88 276.3		0.50 12.7	2.75 69.8	7.25 184.1	4.25 107.9	5.00 127.0
12"	12.75 323.8	24.00 609.6		12.88 327.1	12.92 328.2	12.94 328.7		0.50 12.7	3.12 79.2	7.88 200.1	4.62 117.3	5.62 142.7
14"	14.0 355.6	25.25 641.3		14.14 359.1	14.18 360.2	14.19 360.4		0.50 12.7	3.38 85.8	8.38 212.8	5.12 130.0	6.12 155.4
16"	16.0 406.4	27.75 704.8		16.16 410.5	16.19 411.2	16.19 411.2		0.50 12.7	3.50 88.9	8.50 215.9	5.25 133.3	6.50 165.1
18"	18.0 457.2	31.00 787.4		18.18 461.8	18.20 462.3	18.19 462.0		0.50 12.7	4.00 101.6	9.00 228.6	6.00 152.4	7.50 190.5
20"	20.0 508.0	33.75 857.2		20.20 513.1	20.25 514.3	20.19 512.8		0.50 12.7	4.25 107.9	9.75 247.6	6.25 158.7	8.25 209.5
24"	24.0 609.6	41.00 1041.4		24.25 615.9	24.25 615.9	24.19 614.4		0.50 12.7	5.50 139.7	11.50 292.1	8.00 203.2	10.50 266.7

Note: Socket weld flanges are not available in the pressure rating

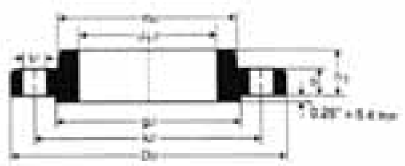


LAP JOINT BLIND SOCKET WELD THREADED

h3	Hub		Raised Face	Drilling Template			Approx. Weight					
h3 in. mm	a in. mm	m in. mm	g in. mm	Num- ber	l in. mm	k in. mm	W/N lbs kg	S/O lbs kg	L/J lbs kg	Blind lbs kg	S/W lbs kg	Thrd lbs kg
USE 1500LB DIMENSIONS FOR THESE SIZES												
1.62 41.1	3.50 88.9	5.00 127.0	5.00 127.0	8	1.00 25.4	7.50 190.5	30.2 13.7	25.6 11.6	24.9 11.3	28.9 13.1		25.6 11.6
1.88 47.8	4.50 114.3	6.25 158.7	6.19 157.2	8	1.25 31.7	9.25 234.9	49.6 22.5	43.4 19.7	42.3 19.2	59.3 26.9		43.4 19.7
2.12 53.8	5.56 141.2	7.50 190.5	7.31 185.6	8	1.38 35.0	11.00 279.4	82.4 37.4	70.3 31.9	68.7 31.2	80.4 36.5		70.3 31.9
2.25 57.1	6.63 168.4	9.25 234.9	8.50 215.9	12	1.25 31.7	12.50 317.5	105 47.7	90.5 41.1	89.2 40.5	104 47.4		90.5 41.1
2.50 63.5	8.63 219.2	11.75 298.4	10.62 269.7	12	1.50 38.1	15.50 393.7	179 81.3	156 70.7	158 71.5	182 82.5		156 70.7
2.81 71.4	10.75 273	14.50 368.3	12.75 323.8	16	1.50 38.1	18.50 469.9	262 119	223 101	229 104	269 122		223 101
3.00 76.2	12.75 323.8	16.50 419.1	15.00 381.0	20	1.50 38.1	21.00 533.4	346 157	293 133	306 139	381 173		293 133
3.25 82.5	14.00 355.6	17.75 450.8	16.25 412.7	20	1.62 41.1	22.00 558.8	379 180	337 153	355 161	454 206		337 153
3.38 85.9	16.00 406.4	20.00 508.0	18.50 469.9	20	1.75 44.4	24.25 615.9	478 217	408 185	427 194	571 259		408 185
3.50 88.9	18.00 457.2	22.25 565.1	21.00 533.4	20	2.00 50.8	27.00 685.8	643 292	568 258	588 267	808 367		568 258
3.62 91.9	20.00 508	24.50 622.3	23.00 584.2	20	2.12 53.8	29.50 749.3	797 362	698 317	736 334	1020 463		698 317
4.00 101.6	24.00 609.6	29.50 749.3	27.25 692.1	20	2.62 66.5	35.50 901.7	1465 665	1335 606	1361 618	1930 876		1335 606



WELDING NECK



SLIP-ON

Pipe		Flange										
Nom. Size	OD in. mm	D in. mm	J in. mm	J1 in. mm	J2 in. mm	J3 in. mm	p in. mm	r in. mm	b in. mm	h in. mm	h1 in. mm	h2 in. mm
1/2"	0.84 21.3	4.75 12.6	Refer to ANSI B36-10/ B36-19 or as specified by purchaser	0.88 22.3	0.90 22.9	0.93 23.6	0.38 9.6	0.12 3.0	0.88 22.3	2.38 60.4	1.25 31.7	1.25 31.7
3/4"	1.05 26.7	5.12 130.0		1.09 27.7	1.11 28.2	1.14 29.0	0.44 11.1	0.12 3.0	1.00 25.4	2.75 69.8	1.38 35.0	1.38 35.0
1"	1.315 33.4	5.88 149.3		1.36 34.5	1.38 35.0	1.41 35.8	0.50 12.7	0.12 3.0	1.12 28.4	2.88 73.1	1.62 41.1	1.62 41.1
1.1/4"	1.66 42.2	6.25 158.7		1.70 43.2	1.72 43.7	1.75 44.4	0.56 14.2	0.19 4.8	1.12 28.4	2.88 73.1	1.62 41.1	1.62 41.1
1.1/2"	1.90 48.3	7.00 177.8		1.95 49.5	1.97 50.0	1.99 50.5	0.62 15.7	0.25 6.4	1.25 31.7	3.25 82.5	1.75 44.5	1.75 44.5
2"	2.375 60.3	8.50 215.9		2.44 62.0	2.46 62.5	2.50 63.5	0.69 17.5	0.31 7.8	1.50 38.1	4.00 101.6	2.25 57.1	2.25 57.1
2.1/2"	2.875 73.0	9.62 244.3		2.94 74.7	2.97 75.4	3.00 76.2	0.75 19.0	0.31 7.8	1.62 41.1	4.12 104.6	2.50 63.5	2.50 63.5
3"	3.50 88.9	10.50 266.7			3.60 91.4	3.63 92.2		0.38 9.6	1.88 47.7	4.62 117.3	2.88 73.15	2.88 73.15
4"	4.50 114.3	12.25 311.1			4.60 116.8	4.63 117.6		0.44 11.1	2.12 53.8	4.88 123.9	3.56 90.42	3.56 90.42
5"	5.563 141.3	14.75 374.6			5.69 144.5	5.69 144.5		0.44 11.1	2.88 73.1	6.12 155.4	4.12 104.65	4.12 104.65
6"	6.625 168.3	15.50 393.7			6.75 171.4	6.75 171.4		0.50 12.7	3.25 82.5	6.75 171.4	4.69 119.13	4.69 119.13
8"	8.625 219.1	19.00 482.6			8.75 222.2	8.75 222.2		0.50 12.7	3.62 91.9	8.38 212.8	5.62 142.75	5.62 142.75
10"	10.75 273	23.00 584.2			10.92 277.4	10.88 276.3		0.50 12.7	4.25 107.9	10.00 254.0	6.25 158.75	7.00 177.8
12"	12.75 323.8	26.50 673.1			12.92 328.2	12.94 328.7		0.50 12.7	4.88 123.9	11.12 282.4	7.12 180.85	8.62 218.9
14"	14.0 355.6	29.50 749.3			14.8 360.2			0.50 12.7	5.25 133.3	11.75 298.4		9.50 241.3
16"	16.0 406.4	32.50 825.5			16.19 411.2			0.50 12.7	5.75 146.0	12.25 311.1		10.25 260.3
18"	18.0 457.2	36.00 914.4			18.20 462.3			0.50 12.7	6.38 162.0	12.88 327.1		10.88 276.3
20"	20.0 508.0	38.75 984.2			20.25 514.3			0.50 12.7	7.00 177.8	14.00 355.6		11.50 292.1
24"	24.0 609.6	46.00 1168.4			24.25 615.9			0.50 12.7	8.00 203.2	16.00 406.4		13.00 330.2

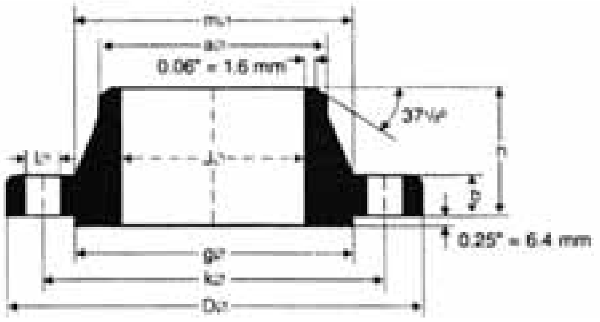
Note: Slip-on and socket weld flanges up to 2.1/2" in this pressure rating
Threaded flanges up to 12" in this pressure rating

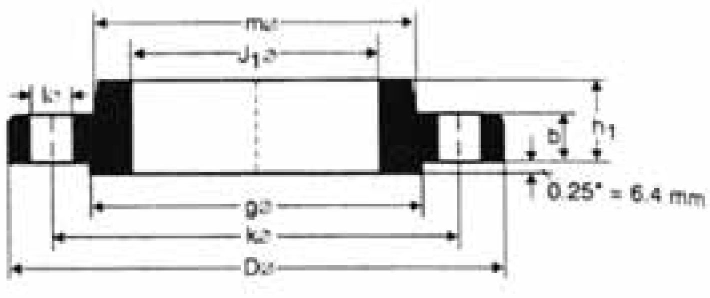


	Hub		Raised Face	Drilling Template			Approx. Weight					
h3 in. mm	a in. mm	m in. mm	g in. mm	Num- ber	l in. mm	k in. mm	W/N lbs kg	S/O lbs kg	L/J lbs kg	Blind lbs kg	S/W lbs kg	Thrd lbs kg
0.88 22.3	0.84 21.3	1.50 38.1	1.38 35.0	4	0.88 22.3	3.25 82.5	4.1 1.87	3.8 1.74	3.8 1.71	3.9 1.77	4.0 1.80	3.9 1.74
1.00 25.4	1.05 26.7	1.75 44.4	0.69 42.9	4	0.88 22.3	3.50 88.9	5.6 2.56	5.2 2.34	5.1 2.30	5.3 2.42	5.3 2.41	5.2 2.34
1.12 28.4	1.32 33.4	2.06 52.3	2.00 50.8	4	1.00 25.4	4.00 101.6	8.2 3.74	7.6 3.44	7.5 3.40	7.9 3.57	7.8 3.55	7.6 3.44
1.19 30.2	1.66 42.2	2.50 63.5	2.50 63.5	4	1.00 25.4	4.38 111.2	9.5 4.33	8.6 3.91	8.4 3.85	9.1 4.14	8.9 4.02	8.6 3.91
1.25 31.7	1.90 48.3	2.75 69.8	2.88 73.1	4	1.12 28.4	4.88 123.9	13.1 5.94	11.8 5.36	11.6 5.28	12.7 5.75	12.0 5.45	11.8 5.36
1.50 33.1	2.38 60.3	4.12 104.6	3.62 91.9	8	1.00 25.4	6.50 165.1	23.8 10.8	21.7 9.85	21.5 9.78	22.2 10.1	22.5 10.2	21.7 9.85
1.88 47.7	2.88 73.0	4.88 123.9	4.12 104.6	8	1.12 28.4	7.50 190.5	33.0 15.0	30.2 13.7	30.0 13.6	30.8 14.0	30.6 13.9	30.2 13.7
2.00 50.8	3.50 88.9	5.25 133.3	5.00 127.0	8	1.25 31.7	8.00 203.2	43.8 19.9		39.2 17.8	42.1 19.1		39.4 17.9
2.25 57.1	4.50 114	6.38 162.0	6.19 157.2	8	1.38 35.0	9.50 241.3	65.9 29.9		60.6 27.5	65.9 29.9		61.2 27.8
2.50 63.5	5.56 141.2	7.75 196.8	7.31 185.6	8	1.62 41.1	11.50 292.1	122 55.4		113 51.5	129 58.4		114 51.8
2.75 69.8	6.63 168.4	9.00 228.6	8.50 215.9	12	1.50 38.1	12.50 317.5	151 68.4		137 62.0	158 71.8		134 61.0
3.00 76.2	8.63 219.2	11.50 292.1	10.62 269.7	12	1.75 44.4	15.50 393.7	258 117		231 105	269 122		227 103
3.31 84.0	10.75 273	14.50 368.3	12.75 323.8	12	2.00 50.8	19.00 482.6	427 194		304 179	463 210		386 175
3.62 91.9	12.75 323.8	17.75 450.8	15.00 381.0	16	2.12 53.8	22.50 571.5	634 288		593 269	696 316		582 264
	14.00 355.6	19.50 495.3	16.25 412.7	16	2.38 60.4	25.00 635.0	837 380		804 365	925 420		
	16.00 406.4	21.75 552.4	18.50 469.9	16	2.62 66.5	27.75 704.8	1068 485		1011 459	1229 558		
	18.00 457.2	23.50 596.9	21.00 533.4	16	2.88 73.1	30.50 774.7	1419 644		1317 598	1674 760		
	20.00 508	25.25 641.3	23.00 584.2	16	3.12 79.2	32.75 831.8	1707 775		1568 712	2126 965		
	24.00 609.6	30.00 762.0	27.25 692.1	16	3.62 91.9	39.00 990.6	2714 1232		2401 1090	3432 1558		

Flanges 2500 lb/sq.in.

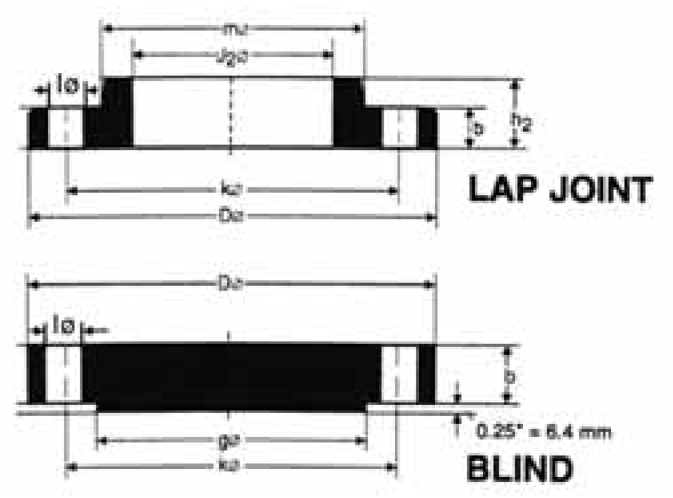
ANSI B16-5

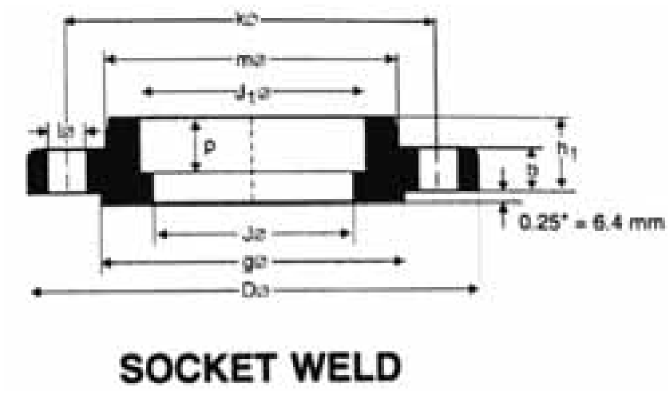




Pipe		Flange										
Nom. Size	OD in. mm	D in. mm	J in. mm *	J1 in. mm	J2 in. mm	J3 in. mm	p in. mm	r in. mm	b in. mm	h in. mm	h1 in. mm	h2 in. mm
_″	0.84 21.3	5.25 133.4	Refer to ANSI B36-10/ B36-19 or as specified by purchaser		0.90 22.9	0.93 23.6		0.12 3.0	1.19 30.2	2.88 73.2	1.56 39.6	1.56 39.6
_″	1.05 26.7	5.50 139.7			1.11 28.2	1.14 29.0		0.12 3.0	1.25 31.8	3.12 79.2	1.69 42.9	1.69 42.9
1″	1.315 33.4	6.25 158.8			1.38 35.1	1.41 35.8		0.12 3.0	1.38 35.1	3.50 88.9	1.88 47.8	1.88 47.8
1 _″	1.66 42.2	7.25 184.2			1.72 43.7	1.75 44.5		0.19 4.8	1.50 38.1	3.75 95.3	2.06 52.3	2.00 52.3
1 _″	1.90 48.3	8.00 203.2			1.97 50.0	1.99 50.5		0.25 6.4	1.75 44.5	4.38 111.3	2.38 60.5	2.38 60.5
2″	2.375 60.3	9.25 235.0			2.46 62.5	2.50 63.5		0.31 7.9	2.00 50.8	5.00 127.0	2.75 69.9	2.75 69.9
2 _″	2.875 73.0	10.50 266.7			2.97 75.4	3.00 76.2		0.31 7.9	2.25 57.2	5.62 142.7	3.12 79.2	3.12 79.2
3″	3.50 88.9	12.00 304.8			3.60 91.4	3.63 92.2		0.38 9.7	2.62 66.5	6.62 168.1	3.62 91.9	3.62 91.9
4″	4.50 114.3	14.00 355.6			4.60 116.8	4.63 117.6		0.44 11.2	3.00 76.2	7.50 190.5	4.25 108.0	4.25 108.0
5″	5.563 141.3	16.50 419.1			5.69 144.5	5.69 144.5		0.44 11.2	3.62 91.9	9.00 228.6	5.12 130.0	5.12 130.0
6″	6.625 168.3	19.00 482.6			6.75 171.5	6.75 171.5		0.50 12.7	4.25 108.0	10.75 273.1	6.00 152.4	6.00 152.4
8″	8.625 219.1	21.75 552.5			8.75 222.3	8.75 222.3		0.50 12.7	5.00 127.0	12.50 317.5	7.00 177.8	7.00 177.8
10″	10.75 273	26.50 673.1			10.92 277.4	10.88 276.4		0.50 12.7	6.50 165.1	16.50 419.1	9.00 228.6	9.00 228.6
12″	12.75 323.8	30.00 762.0			12.92 328.2	12.94 328.7		0.50 12.7	7.25 184.2	18.25 463.6	10.00 254.0	10.00 254.0

Note: Slip-on and Socket weld flanges are not available in this pressure rating.
Weld necks, Lap joint, Blind and Threaded flanges up to 12″ in this pressure rating.

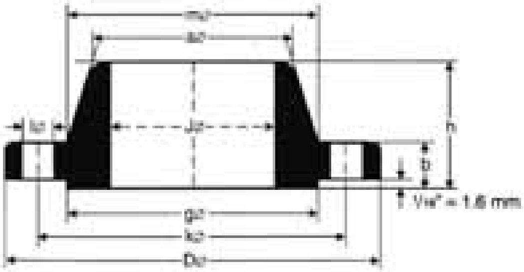




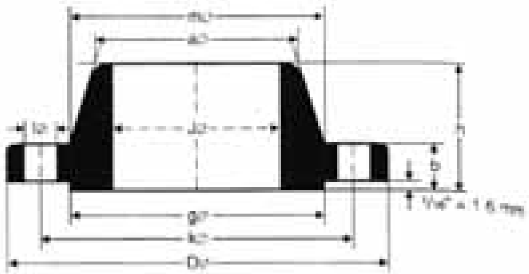
Hub		Raised Face		Drilling Template			Approx.	Weight				
h3 in. mm	a in. mm	m in. mm	g in. mm	Num-ber	l in. mm	k in. mm	W/N lbs kg	S/O lbs kg	L/J lbs kg	Blind lbs kg	S/W lbs kg	Thrd lbs kg
1.12 28.4	0.84 21.3	1.69 42.9	1.38 35.1	4	0.88 22.4	3.50 88.5	6.9 3.12		6.4 2.92	6.6 2.99		6.5 2.95
1.25 31.8	1.05 26.7	2.00 50.8	1.69 42.9	4	0.88 22.4	3.75 95.3	8.1 3.70		7.5 3.40	7.7 3.50		7.6 3.44
1.38 35.1	1.32 33.5	2.25 57.2	2.00 50.8	4	1.00 25.4	4.25 108.0	11.5 5.24		10.5 4.77	10.9 4.96		10.6 4.82
1.50 38.1	1.66 42.2	2.88 73.2	2.50 63.5	4	1.12 28.4	5.12 130.0	17.0 7.74		15.6 7.08	16.2 7.35		15.7 7.14
1.75 44.5	1.90 48.3	3.12 79.2	2.88 73.2	4	1.25 31.8	5.75 146.1	24.0 10.9		21.9 9.93	22.9 10.4		22.0 10.0
2.00 50.8	2.38 60.5	3.75 95.3	3.62 91.9	8	1.12 28.4	6.75 171.5	35.7 16.2		32.4 14.7	34.4 15.6		32.6 14.8
2.25 57.2	2.88 73.2	4.50 114.3	4.12 104.6	8	1.25 31.8	7.75 196.9	52.2 23.7		46.9 21.3	49.8 22.6		47.4 21.5
2.50 63.5	3.50 88.9	5.25 133.4	5.00 127.0	8	1.38 35.1	9.00 228.6	79.7 36.2		71.1 32.3	76.7 34.8		71.8 32.6
2.75 69.9	4.50 114.3	6.50 165.1	6.19 157.2	8	1.62 41.1	10.75 273.1	122 55.3		116 52.5	119 53.9		117 52.9
3.00 76.2	5.56 141.2	8.00 203.2	7.31 185.7	8	1.88 47.8	12.75 323.9	204 92.5		182 82.6	200 90.8		183 83.1
7.25 82.6	6.63 168.4	9.25 235.0	8.50 215.9	8	2.12 53.8	14.50 368.3	315 143		280 127	311 141		282 128
3.75 95.3	8.63 219.2	12.00 304.8	10.62 269.7	12	2.12 53.8	17.25 438.2	474 215		410 186	471 214		414 188
4.25 108.0	10.75 273.1	14.75 374.7	12.75 323.9	12	2.62 66.5	21.25 539.8	894 406		775 352	905 411		782 355
4.75 120.7	12.75 323.9	17.38 441.5	15.00 381.0	12	2.88 73.2	24.38 619.3	1260 572		1104 501	1304 592		1110 504

150 lb/sq.in. Welding Neck Flanges

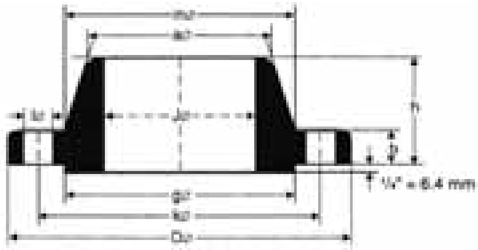
MSS SP-44



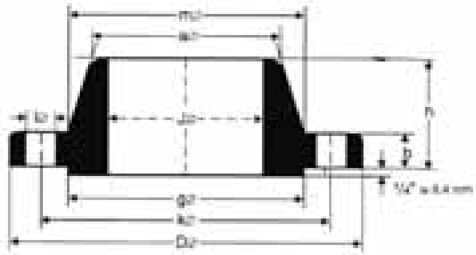
Pipe		Flange				Hub		Raised Face	Drilling Template			Appr. Weight
Nom. Size	OD in. mm	D in. mm	J in. mm	b in. mm	h in. mm	a in. mm	m in. mm	g in mm	Num ber	l in. mm	k in mm	Pounds Kilo
26″	26.0 660.4	34 _ 869.9	To be specified by purchaser	2 11/16 68.3	4 _ 120.6	To be specified by purchaser	26 5/8 676.3	29 _ 749.3	24	1 3/8 34.9	31 _ 806.4	To be specified by purchaser
28″	28.0 711.2	36 _ 927.1		2 11/16 71.4	415/16 125.4		28 5/8 727.1	31 _ 800.1	28	1 3/8 34.9	34 863.6	
30″	30.0 762.0	38 _ 984.2		2 15/16 74.6	5 3/8 136.5		30 _ 781.0	33 _ 857.2	28	1 3/8 34.9	36 914.4	
32″	32.0 812.8	41 _ 1060.4		3 3/16 81.0	5 11/16 144.5		32 _ 831.8	36 914.4	28	1 5/8 41.3	38 _ 977.9	
34″	34.0 863.6	43 _ 1111.2		3 _ 82.5	5 7/8 149.2		34 _ 882.6	38 965.2	32	1 5/8 41.3	40 _ 1028.7	
36″	36.0 914.4	46 1168.4		3 9/16 90.5	6 3/16 157.2		36 _ 933.4	40 _ 1022.3	32	1 5/8 41.3	42 _ 1085.8	
38″	38.0 965.2	48 _ 1238.2		3 7/16 87.3	6 3/16 157.1		39 990.6	42 _ 1073.1	32	1 5/8 41.3	45 _ 1149.3	
40″	40.0 1016.0	50 _ 1289.0		3 9/16 90.5	6 7/16 163.5		41 1041.4	44 _ 1123.9	36	1 5/8 41.3	47 _ 1200.1	
42″	42.0 1066.8	53 1346.2		3 13/16 96.8	6 _ 171.4		43 1092.2	47 1193.8	36	1 5/8 41.3	49 _ 1257.3	
44″	44.0 1117.6	55 _ 1403.3		4 101.6	7 177.8		45 1143.0	49 1244.6	40	1 5/8 41.3	51 _ 1314.4	
46″	46.0 1168.4	57 _ 1454.1		4 1/16 103.1	7 5/16 185.7		47 1/8 1196.9	51 1295.4	40	1 5/8 41.3	53 _ 1365.2	
48″	48.0 1219.2	59 _ 1511.3		4 _ 107.9	7 9/16 192.0		49 1/8 1247.6	53 _ 1358.9	44	1 5/8 41.3	56 1422.4	
50″	50.0 1270.0	61 _ 1568.4		4 3/8 111.1	8 203.2		51 _ 1301.7	55 _ 1409.7	44	1 7/8 47.7	58 _ 1479.5	
52″	52.0 1320.8	64 1625.6		4 9/16 115.8	8 _ 209.5		53 _ 1352.5	57 _ 1460.5	44	1 7/8 47.7	60 _ 1536.7	
54″	54.0 1371.6	66 _ 1682.7		4 _ 120.6	8 _ 215.9		55 _ 1403.3	59 _ 1511.3	44	1 7/8 47.7	62 _ 1593.8	
56″	56.0 1422.4	68 _ 1746.2		4 7/8 123.8	9 228.6		57 3/8 1457.4	62 1574.8	48	1 7/8 47.7	65 1651.0	
58″	58.0 1473.2	71 1803.4		5 1/16 128.5	9 _ 234.9		59 3/8 1508.2	64 1625.6	48	1 7/8 47.7	67 _ 1708.1	
60″	60.0 1524.0	73 1854.2		5 3/16 131.7	9 7/16 239.7		61 3/8 1559.0	66 1676.4	52	1 7/8 47.7	69 _ 1758.9	



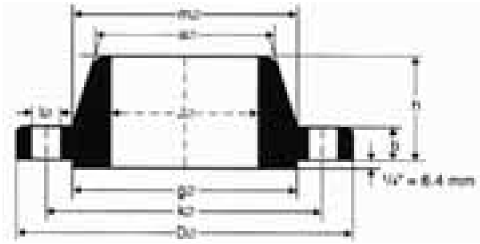
Pipe		Flange				Hub		Raised Face	Drilling Template			Appr. Weight
Nom. Size	OD in. mm	D in. mm	J in. mm*	b in. mm	h in. mm	a in. mm*	m in. mm	g in mm	Num ber	l in. mm	k in mm	Pounds Kilo *
26″	26.0 660.4	38 _ 971.5		3 1/8 79.4	7 _ 184.1		28 3/8 720.7	29 _ 749.3	28	1 _ 44.3	34 _ 876.3	
28″	28.0 711.2	40 _ 1035.0		3 1/8 85.7	7 _ 196.8		30 _ 774.7	31 _ 800.0	28	1 _ 44.4	37 939.8	
30″	30.0 762	43 1092.2		3 5/8 92.1	8 _ 209.5		32 9/16 827.1	33 _ 857.2	28	1 7/8 47.6	39 _ 996.9	
32″	32.0 812.8	45 _ 1149.3		3 7/8 98.4	8 _ 222.2		34 11/16 881.1	36 914.4	28	2 42 _ 50.8	1054.1	
34″	34.0 863.6	47 _ 1206.5		4 101.6	9 1/8 231.8		36 7/8 936.6	38 965.2	28	2 43 _ 50.8	1104.9	
36″	36.0 914.4	50 1270.0		4 1/8 104.8	9 _ 241.3		39 990.6	40 _ 1022.3	32	2 1/8 54	46 1168.4	
38″	38.0 965.2	46 1168.4		4 _ 107.9	7 1/8 180.9		39 1/8 993.7	40 _ 1028.7	32	1 5/8 41.2	43 1092.2	
40″	40.0 1016.0	48 _ 1238.2		4 _ 114.3	7 5/8 193.6		41 _ 1047.7	42 _ 1085.8	32	1 _ 44.4	45 _ 1155.7	
42″	42.0 1066.8	50 _ 1289.0	To be specified by purchaser	4 11/16 119.1	7 7/8 200.1	To be specified by purchaser	43 _ 1098.5	44 _ 1136.6	32	1 _ 44.4	47 _ 1206.5	To be specified by purchaser
44″	44.0 1117.6	53 _ 1352.5		4 7/8 123.9	8 1/8 206.3		45 _ 1149.3	47 1193.8	32	1 7/8 47.6	49 _ 1263.6	
46″	46.0 1168.4	55 _ 1416.0		5 1/16 128.5	8 _ 215.9		47 3/8 1203.4	49 1244.6	28	2 52 50.8	1320.8	
48″	48.0 1219.2	57 _ 1466.8		5 _ 133.4	8 13/16 223.8		49 3/8 1254.1	51 _ 1301.7	32	2 54 50.8	1371.6	
50″	50.0 1270.0	60 _ 1530.3		5 _ 139.7	9 1/8 231.7		51 3/8 1304.9	53 _ 1358.9	32	2 1/8 53.9	56 _ 1428.7	
52″	52.0 1320.8	62 _ 1581.1		5 11/16 144.5	9 3/8 238.1		53 3/8 1355.7	55 _ 1409.7	32	2 1/8 53.9	58 _ 1479.5	
54″	54.0 1371.6	65 _ 1657.3		6 152.4	9 15/16 252.4		55 _ 1409.7	57 _ 1466.8	28	2 3/8 60.3	61 1549.4	
56″	56.0 1422.4	67 _ 1708.1		6 1/16 153.9	10 _ 260.3		57 5/8 1463.6	59 _ 1517.6	28	2 3/8 60.3	63 1600.2	
58″	58.0 1473.2	69 _ 1758.9		6 _ 158.7	10 _ 266.7		59 5/8 1514.4	62 1574.8	32	2 3/8 60.3	65 1651.0	
60″	60.0 1524.0	71 _ 1809.7		6 7/16 163.5	10 _ 273.0		61 5/8 1565.2	64 1625.6	32	2 3/8 60.3	67 1701.8	



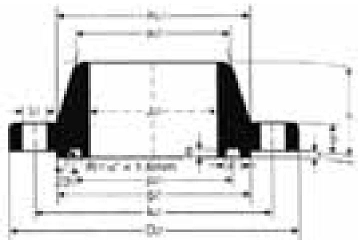
Pipe		Flange				Hub		Raised Face	Drilling Template			Appr. Weight
Nom. Size	OD in. mm	D in. mm	J in. mm	b in. mm	h in. mm	a in. mm	m in. mm	g in mm	Num ber	l in. mm	k in mm	Pounds Kilo
26″	26.0 660.4	38 _ 971.5	To be specified by purchaser	3 _ 88.9	7 5/8 193.7	To be specified by purchaser	28 5/8 727.1	29 _ 749.3	28	1 7/8 47.6	34 _ 846.3	To be specified by purchaser
28″	28.0 711.2	40 _ 1035.0		3 _ 95.2	8 1/8 206.4		30 13/16 782.6	31 _ 800.1	28	2 37 50.8	939.8	
30″	30.0 762	43 1092.2		4 101.6	8 5/8 219.1		32 15/16 836.6	33 _ 857.2	28	2 1/8 54.0	39 _ 996.9	
32″	32.0 812.8	45 _ 1149.3		4 _″ 107.9	9 1/8 231.8		35 889.0	36 914.4	28	2 1/8 54.0	41 _ 1054.1	
34″	34.0 863.6	47 _ 1206.5		4 3/8 111.1	9 _ 241.3		37 3/16 944.6	38 965.2	28	2 1/8 54.0	43 _ 1104.9	
36″	36.0 914.4	50 1270.0		4 _ 114.3	9 7/8 250.8		39 1/8 1000.1	40 _ 1022.3	32	2 1/8 54.0	46 1168.4	
38″	38.0 965.2	47 _ 1206.5		4 7/8 123.8	8 1/8 206.3		39 _ 1003.3	40 _ 1035.0	32	1 7/8 47.6	44 1117.6	
40″	40.0 1016.0	50 1270.0		5 1/8 130.1	8 _ 215.9		41 _ 1054.1	43 1092.2	32	2 46 _ 50.8	1174.7	
42″	42.0 1066.8	52 1320.8		5 _ 133.3	8 13/16 223.8		43 5/8 1108.0	45 1143.0	32	2 48 _ 50.8	1225.5	
44″	44.0 1117.6	54 _ 1384.3		5 _ 139.7	9 3/16 233.3		45 5/8 1158.8	47 _ 1200.1	32	2 1/8 53.9	50 _ 1282.7	
46″	46.0 1168.4	56 _ 1441.4		5 _ 146.0	9 5/8 244.0		47 _ 1212.8	49 _ 1257.3	36	2 1/8 53.9	52 _ 1339,8	
48″	48.0 1219.2	59 _ 1511.3		6 152.4	10 1/8 257.1		49 7/8 1266.8	51 _ 1308.1	28	2 3/8 60.3	55 _ 1403.3	
50″	50.0 1270.0	61 _ 1568.4		6 3/16 157.2	10 9/16 268.2		52 1320.8	53 5/8 1362.0	32	2 3/8 60.3	57 _ 1460.5	
52″	52.0 1320.8	63 _ 1619.2		6 3/8 161.9	10 7/8 276.2		54 1371.6	55 5/8 1412.8	32	2 3/8 60.3	59 _ 1511.3	
54″	54.0 1371.6	67 1701.8		6 11/16 169.9	11 3/8 288.9		56 1/8 1425.5	57 7/8 1470.0	28	2 5/8 66.6	62 _ 1581.1	
56″	56.0 1422.4	69 1752.6		6 7/8 174.6	11 _ 298.4		58 _ 1479.5	60 1/8 1527.1	32	2 5/8 66.6	64 _ 1631.9	
58″	58.0 1473.2	71 1803.4		7 177.8	12 1/16 306.3		60 _ 1530.3	62 1/8 1577.9	32	2 5/8 66.6	66 _ 1682.7	
60″	60.0 1524.0	74 _ 1885.9		7 5/16 185.7	12 9/16 319.0		62 3/8 1584.3	64 3/8 1635.1	32	2 7/8 73.0	69 1752.6	



Pipe		Flange				Hub		Raised Face	Drilling Template			Appr. Weight
Nom. Size	OD in. mm	D in. mm	J in. mm	b in. mm	h in. mm	a in. mm	m in. mm	g in mm	Number	l in. mm	k in mm	Pounds Kilo
26″	26.0 660.4	40 1016.0		4 _ 107.9	8 _ 222.2		7/16 747.7	29 _ 749.3	28	2 50.8	36 914.4	
28″	28.0 711.2	42 _ 1073.1		4 3/8 111.1	9 _ 234.9		5/8 803.3	31 _ 800.1	28	2 1/8 54.0	38 965.2	
30″	30.0 762	44 _ 1130.3		4 _ 114.3	9 _ 247.6		16/16 862.0	33 _ 857.2	28	2 1/8 54.0	40 _ 1022.3	
32″	32.0 812.8	47 1193.8		4 5/8 117.5	10 _ 260.3		36 1/8 917.6	36 914.4	28	2 3/8 60.3	42 _ 1079.5	
34″	34.0 863.6	49 1244.6		4 _ 120.6	10 5/8 269.9		38 5/16 973.1	38 965.2	28	2 3/8 60.3	44 _ 1130.3	
36″	36.0 914.4	51 _ 1314.4		4 7/8 123.8	11 1/8 282.6		40 5/8 1031.9	40 _ 1022.3	28	2 5/8 66.7	47 1193.8	
38″	38.0 965.2	50 1270.0		6 152.4	10 254.0		40 _ 1022.3	41 _ 1054.1	28	2 3/8 60.3	45 _ 1162.0	
40″	40.0 1016.0	52 1320.8	To be specified by purchaser	6 _ 158.7	10 3/8 263.5	To be specified by purchaser	42 _ 1073.1	43 _ 1111.2	32	2 3/8 60.3	47 _ 1212.8	To be specified by purchaser
42″	42.0 1066.8	55 _ 1403.3		6 5/8 168.2	11 279.4		44 3/8 1127.1	46 1168.4	28	2 5/8 66.7	50 _ 1282.7	
44″	44.0 1117.6	57 _ 1554.1		6 13/16 173.0	11 3/8 288.9		46 _ 1181.1	48 _ 1225.5	32	2 5/8 66.7	52 _ 1333.5	
46″	46.0 1168.4	59 _ 1511.3		7 1/16 179.3	11 13/15 300.0		8 5/8 1235.1	50 _ 1276.3	32	2 5/8 66.7	54 _ 1390.6	
48″	48.0 1219.2	62 _ 1593.8		7 7/16 188.9	12 7/16 315.9		50 _ 1289.0	52 _ 1333.5	32	2 7/8 73.0	57 _ 1460.5	
50″	50.0 1270.0	65 _ 1670.0		7 _ 196.8	12 15/16 328.6		50 7/8 1292.2	54 _ 1384.3	28	3 1/8 79.3	60 1524.0	
52″	52.0 1320.8	67 _ 1720.8		8 203.2	13 _ 336.5		54 7/8 1393.8	56 _ 1435.1	32	3 1/8 79.3	62 1574.8	
54″	54.0 1371.6	70 1778.0		8 _ 209.5	13 _ 349.2		57 1447.8	58 _ 1492.21	32	3 1/8 79.3	64 _ 1631.9	
56″	56.0 1422.4	73 1854.2		8 9/16 217.4	14 _ 361.9		59 1/8 1501.7	60 _ 1543.0	32	3 3/8 85.7	66 _ 1695.4	
58″	58.0 1473.2	75 1905.0		8 _ 222.2	14 9/16 369.8		61 1/8 1552.5	63 1600.2	32	3 3/8 85.7	68 _ 1746.2	
60″	60.0 1524.0	78 _ 1993.9		9 3/16 233.4	15 5/16 388.9		63 3/8 1609.7	65 _ 1657.3	28	3 5/8 92.0	71 _ 1822.4	



Pipe		Flange				Hub		Raised Face	Drilling Template			Appr. Weight
Nom. Size	OD in. mm	D in. mm	J in. mm	b in. mm	h in. mm	a in. mm	m in. mm	g in mm	Num ber	l in. mm	k in mm	Pounds Kilo
26″	26.0 660.4	42 _ 1085.8	To be specified by purchaser	5 _ 139.7	11 _ 285.7	To be specified by purchaser	30 _ 774.4	29 _ 749.3	20	2 7/8 73.0	37 _ 952.5	To be specified by purchaser
28″	28.0 711.2	46 1168.4		5 5/8 142.9	11 _ 298.4		32 _ 831.8	31 _ 800.1	20	3 1/8 79.4	40 _ 1022.3	
30″	30.0 762	48 _ 1231.9		5 7/8 149.2	12 _ 311.1		35 889.0	33 _ 857.2	20	3 1/8 79.4	42 _ 1085.8	
32″	32.0 812.8	51 _ 1314.4		6 _ 158.7	13 330.2		37 _ 946.1	36 914.4	20	3 3/8 85.7	45 _ 1155.7	
34″	34.0 863.6	55 1397.0		6 _ 165.1	13 _ 349.2		39 5/8 1006.5	38 965.2	20	3 5/8 92.1	48 _ 1225.5	
36″	36.0 914.4	57 _ 1460.5		6 _ 171.4	14 _ 361.9		41 7/8 1063.6	40 _ 1022.3	20	3 5/8 92.1	50 _ 1289.0	
38″	38.0 965.2	57 _ 1460.5		7 _ 190.5	13 7/8 352.4		42 _ 1073.1	43 _ 1098.5	20	3 5/8 92.1	50 _ 1289.0	
40″	40.0 1016.0	59 _ 1511.3		7 _ 196.8	14 5/16 363.5		44 3/8 1127.1	45 _ 1162.0	24	3 5/8 92.1	52 _ 1339.8	
42″	42.0 1066.8	61 _ 1562.1		8 1/8 206.3	14 5/8 371.4		46 5/16 1176.3	47 _ 1212.8	24	3 5/8 92.1	54 _ 1390.6	
44″	44.0 1117.6	64 7/8 1647.8		8 7/16 214.3	15 3/8 390.5		48 5/8 1235.0	50 1270.0	24	3 7/8 98.4	57 5/8 1463.6	
46″	46.0 1168.4	68 _ 1733.5		8 7/8 225.4	16 3/16 411.1		50 7/8 1292.2	52 _ 1333.5	24	4 1/8 104.7	60 _ 1536.7	
48″	48.0 1219.2	70 _ 1784.3		9 3/16 233.4	16 _ 419.1		52 7/8 1343.0	54 _ 1384.3	24	4 1/8 104.7	62 _ 1587.5	



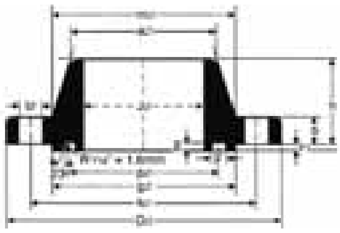
300 lb/sq.in.

1) f=Height of raised portion and depth of groove dimensions »E« but not covered by tolerances for »E«.

Pipe		Flange				Hub		Raised Face	Drilling Template			Ring Joint			Approx.
Nom. Size	OD in. mm	D in. mm	J in. mm	b in. mm	h in. mm	a in. mm	m in. mm	g in. mm	Number	l in. mm	k in. mm	p in. mm	E in. mm	F in. kilo	Pounds
26″	26.0 660.4	38 _ 971.5	To be specified by purchaser	3 1/8 79.4	7 1/4 184.1	To be specified by purchaser	28 3/8 720.7	31 7/8 809.6	28	1 3/4 44.4	34 1/2 876.3	29 1/2 749.3	1/2 12.7	25/32 19.8	To be specified by purchaser
28″	28.0 711.2	40 3/4 1035.0		3 3/8 85.7	7 3/4 196.8		30 1/2 774.7	33 7/8 860.4	28	1 3/4 44.4	37 939.8	31 1/2 800.1	1/2 12.7	25/32 19.8	
30″	30.0 762	43 1092.2		3 5/8 92.1	8 1/4 209.5		32 9/16 827.1	36 1/8 917.6	28	1 7/8 47.6	39 1/4 996.9	33 3/4 857.2	1/2 12.7	25/32 19.8	
32″	32.0 812.8	45 1/4 1149.3		3 7/8 98.4	8 3/4 222.2		34 11/16 881.1	38 3/4 984.2	28	2 50.8	41 1/2 1054.1	36 914.4	9/16 14.3	29/32 23.0	
34″	34.0 863.6	47 1/2 1206.5		4 101.6	9 1/8 231.8		36 7/8 936.6	40 3/4 1035.0	28	2 50.8	43 1/2 1104.9	38 965.2	9/16 14.3	29/32 23.0	
36″	36.0 914.4	50 1270.0		4 1/8 104.8	9 1/2 241.3		39 990.6	43 1092.2	32	2 1/8 54.0	46 1168.4	40 1/4 1022.3	9/16 14.3	29/32 23.0	

400 lb/sq.in.

Pipe		Flange				Hub		Raised Face	Drilling Template			Ring Joint			Approx.
Nom. Size	OD in. mm	D in. mm	J in. mm	b in. mm	h in. mm	a in. mm	m in. mm	g in. mm	Number	l in. mm	k in. mm	p in. mm	E in. mm	F in. kilo	Pounds
26″	26.0 660.4	38 _ 971.5	To be specified by purchaser	3 1/2 88.9	7 5/8 193.7	To be specified by purchaser	28 5/8 727.1	31 7/8 809.6	28	1 7/8 47.6	34 1/2 876.3	29 1/2 749.3	1/2 12.7	25/32 19.8	To be specified by purchaser
28″	28.0 711.2	40 3/4 1035.0		3 3/4 95.2	8 1/8 206.4		30 13/16 782.6	33 7/8 860.4	28	2 50.8	37 939.8	31 1/2 800.1	1/2 12.7	25/32 19.8	
30″	30.0 762	43 1092.2		4 101.6	8 5/8 219.1		32 15/16 836.6	36 1/8 917.6	28	2 1/8 54.0	39 1/4 996.9	33 3/4 857.2	1/2 12.7	25/32 19.8	
32″	32.0 812.8	45 1/4 1149.3		4 1/4 107.9	9 1/8 231.8		35 889.0	38 3/4 984.2	28	2 1/8 54.0	41 1/2 1054.1	36 914.4	9/16 14.3	29/32 23.0	
34″	34.0 863.6	47 1/2 1206.5		4 3/8 111.1	9 1/2 241.3		37 3/16 944.6	40 3/4 1035.0	28	2 1/8 54.0	43 1/2 1104.9	38 965.2	9/16 14.3	29/32 23.0	
36″	36.0 914.4	50 1270.0		4 1/2 114.3	9 7/8 250.8		39 3/8 1000.1	43 1092.2	32	2 1/8 54.0	46 1168.4	40 1/4 1022.3	9/16 14.3	29/32 23.0	



1) f=Height of raised portion and depth of groove dimensions »E« but not covered by tolerances for »E«.

600 lb/sq.in.

Pipe		Flange				Hub		Raised Face	Drilling Template			Ring Joint			Approx.
Nom. Size	OD in. mm	D in. mm	J in. mm	b in. mm	h in. mm	a in. mm	m in. mm	g in. mm	Num-ber	l in. mm	k in. mm	p in. mm	E in. mm	F in. kilo	Pounds
26"	26.0 660.4	40 1016.0	To be specified by purchaser	4 1/4 107.9	8 3/4 222.2	To be specified by purchaser	29 7/16 747.7	31 7/8 809.6	28	2 50.8	36 914.4	29 1/2 749.3	1/2 12.7	25/32 19.8	To be specified by purchaser
28"	28.0 711.2	42 1/4 1073.1		4 3/8 111.1	9 1/4 234.9		31 5/8 803.3	33 7/8 860.4	28	2 1/8 54.0	38 965.2	31 1/2 800.1	1/2 12.7	25/32 19.8	
30"	30.0 762	44 1/2 1130.3		4 1/2 114.3	9 3/4 247.6		33 15/16 862.0	36 1/8 917.6	28	2 1/8 54.0	40 1/4 1022.3	33 3/4 857.2	1/2 12.7	25/32 19.8	
32"	32.0 812.8	47 1193.8		4 5/8 117.5	10 1/4 260.3		36 1/8 917.6	38 3/4 984.2	28	2 3/8 60.3	42 1/2 1079.5	36 914.4	9/16 14.3	29/32 23.0	
34"	34.0 863.6	49 1244.6		4 3/4 120.6	10 5/8 269.9		38 5/16 973.1	40 3/4 1035.0	28	2 3/8 60.3	44 1/2 1130.3	38 965.2	9/16 14.3	29/32 23.0	
36"	36.0 914.4	51 3/4 1314.4		4 7/8 123.8	11 1/8 282.6		40 5/8 1031.9	43 1092.2	28	2 5/8 66.7	47 1193.8	40 1/4 1022.3	9/16 14.3	29/32 23.0	

900 lb/sq.in.

Pipe		Flange				Hub		Raised Face	Drilling Template			Ring Joint			Approx.
Nom. Size	OD in. mm	D in. mm	J in. mm	b in. mm	h in. mm	a in. mm	m in. mm	g in. mm	Num-ber	l in. mm	k in. mm	p in. mm	E in. mm	F in. kilo	Pounds
26"	26.0 660.4	42 3/4 1085.8	To be specified by purchaser	5 1/2 139.7	11 1/4 285.7	To be specified by purchaser	31 1/2 774.4	32 3/4 831.8	20	2 7/8 73.0	37 1/2 952.5	29 1/2 749.3	11/16 17.5	1 3/16 30.2	To be specified by purchaser
28"	28.0 711.2	46 1168.4		5 5/8 142.9	11 3/4 298.4		32 3/4 831.8	35 889.0	20	3 1/8 79.4	40 1/4 1022.3	31 1/2 800.1	11/16 17.5	1 5/16 33.3	
30"	30.0 762	48 1/2 1231.9		5 7/8 149.2	12 1/4 311.1		35 889.0	37 1/4 946.1	20	3 1/8 79.4	42 3/4 1085.8	33 3/4 857.2	11/16 17.5	1 5/16 33.3	
32"	32.0 812.8	51 3/4 1314.4		6 1/4 158.7	13 330.2		37 1/4 946.1	39 1/2 1003.3	20	3 3/8 85.7	45 1/2 1155.7	36 914.4	11/16 17.5	1 5/16 33.3	
34"	34.0 863.6	55 1397.0		6 1/2 165.1	13 3/4 349.2		39 5/8 1006.5	42 1066.8	20	3 5/8 92.1	48 1/4 1225.5	38 965.2	13/16 20.6	1 7/16 36.5	
36"	36.0 914.4	57 1/2 1460.5		6 3/4 171.4	14 1/4 361.9		41 7/8 1063.6	44 1/4 1123.9	20	3 5/8 92.1	50 3/4 1289.0	40 1/4 1022.3	13/16 20.6	1 7/16 36.5	

Nominal Sizes from 26″ to 60″
Standard for large diameter carbon steel flanges
for nominal pressure ratings of 150 and 300 lb/sq.in.

General Survey

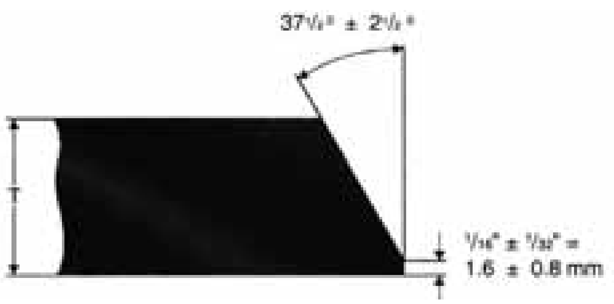
Nominal Pressure lb/sq.in.	150	300	Attention!
kp/cm2	10.6	21.1	Flanges to API Standard 605 are not
N/cm2	104	207	identical with MSS SP 44 and BS 3293
Type of Flange	max. Nominal Sizes		
Welding Neck Flanges	60″	60″	

Facings and Dimensional Tolerances acc. to ANSI B 16.5

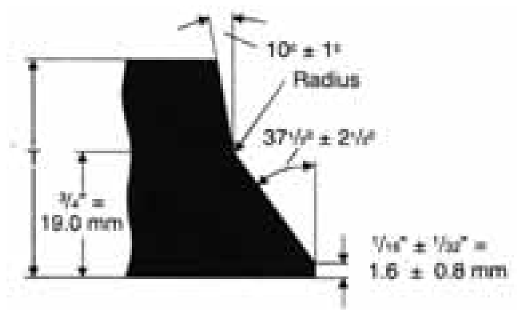
Example of Marking
The Flanges are marked with the following information:

Manufacturer/s name or trade mark
Nominal size
Primary service pressure
Material designation
Heat code
Schedule No.
recognition letter x before
Primary service pressure

Welding Ends:



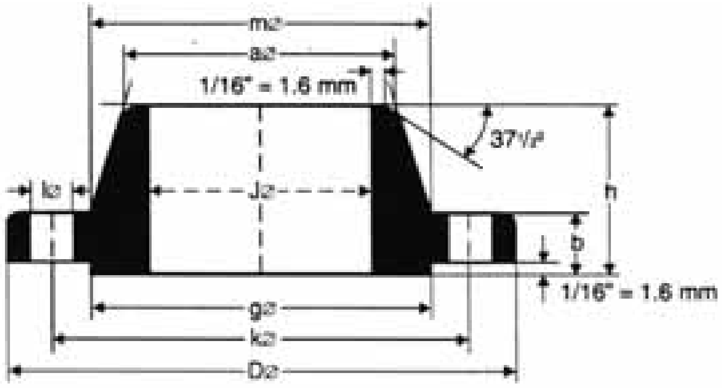
Bevel for Wall Thickness (T) 3/16″ to 7/8″ inclusive



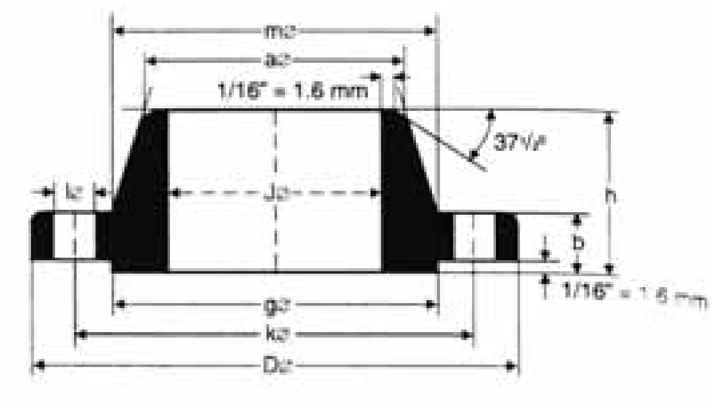
Bevel for Wall Thickness (T) greater than 7/8″

150 lb/sq.in. Welding Neck Flanges

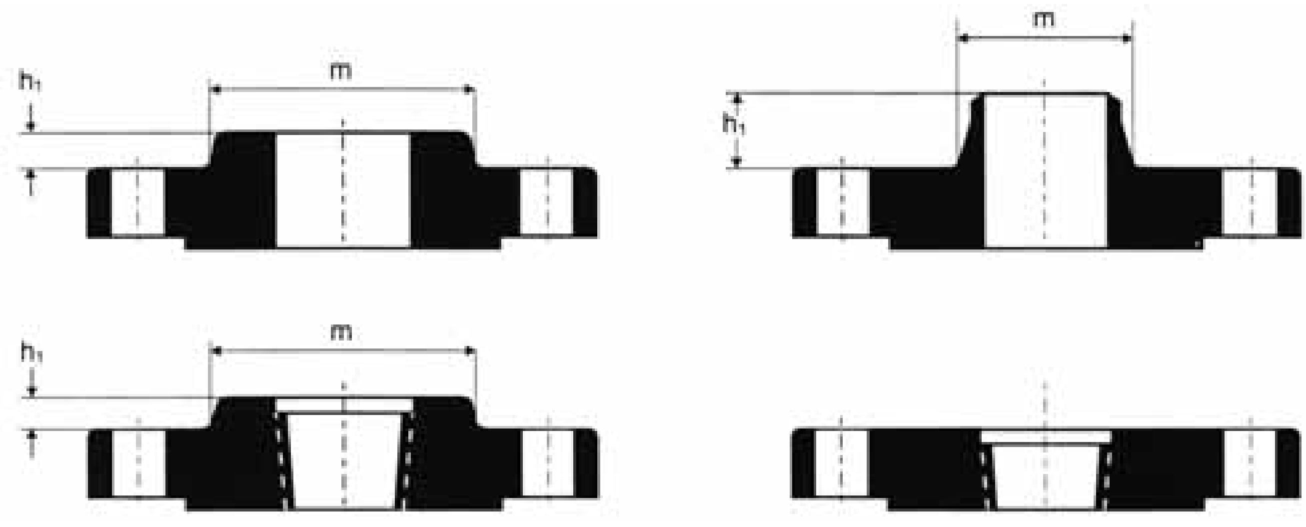
API STANDARD 605



Pipe		Flange				Hub		Raised Face	Drilling Template			Appr. Weight
Nom. Size	OD in. mm	D in. mm	J in. mm	b in. mm	h in. mm	a in. mm	m in. mm	g in mm	Num ber	l in. mm	k in mm	Pounds Kilo
26″	26.0 660.4	34 15/16 785.8	To be specified by purchaser	1 5/8 41.3	3 1/2 88.9	26 1/16 662.0	26 15/16 684.2	28 711.2	36	7/8 22.2	29 5/16 744.5	139 63
28″	28.0 711.2	32 15/16 836.6		1 3/4 44.4	3 3/4 95.2	28 1/16 712.8	28 15/16 735.0	30 762.0	40	7/8 22.2	31 5/16 795.3	163 74
30″	30.0 762	34 15/16 887.4		1 3/4 44.4	3 15/16 100.0	30 1/16 763.6	31 787.4	32 812.8	44	7/8 22.2	33 5/16 846.1	176 80
32″	32.0 812.8	37 1/16 941.4		1 13/16 46	4 1/4 107.9	32 1/16 814.4	33 1/16 839.8	34 863.6	48	7/8 22.2	35 7/16 900.1	203 92
34″	34.0 863.6	39 9/16 1004.9		1 15/16 49.2	4 11/32 110.3	34 1/16 865.2	35 1/8 892.2	36 1/4 920.7	40	1 37 11/16 25.4	957.3	249 113
36″	36.0 914.4	41 5/8 1057.3		2 1/16 52.4	4 5/8 117.5	36 1/16 916.0	37 3/16 944.6	38 1/4 971.5	44	1 39 3/4 25.4	284 1009.6	129
42″	42.0 1066.8	48 1/4 1225.5		2 5/16 58.7	5 1/4 133.3	42 1/8 1070.0	43 3/8 1101.7	44 1/2 1130.3	48	1 1/8 28.6	46 1/8 1171.6	406 184
48″	48.0 1219.2	54 13/16 1392.2		2 9/16 65.1	5 7/8 149.2	48 1/8 1222.4	49 1/2 1257.3	50 3/4 1289.0	44	1 1/4 31.7	52 9/16 1335.1	509 231
54″	54.0 1371.6	61 1549.4		2 13/16 71.4	6 3/8 161.9	54 1/8 1374.8	55 5/8 1412.9	56 3/4 1441.9	56	1 1/4 31.7	58 3/4 1492.2	632 287
60″	60.0 1524	67 15/16 1725.6		3 76.2	7 1/16 179.4	60 1/8 1527.2	61 13/16 1570.0	63 1600.2	52	1 3/8 34.9	66 7/16 1662.1	855 388



Pipe		Flange				Hub		Raised Face	Drilling Template			Appr. Weight
Nom. Size	OD in. mm	D in. mm	J in. mm	b in. mm	h in. mm	a in. mm	m in. mm	g in mm	Num ber	l in. mm	k in mm	Pounds Kilo
26"	26.0 660.4	34 1/8 866.8	To be specified by purchaser	3 1/2 88.9	5 11/16 144.5	26 3/16 665.2	27 5/8 701.7	29 736.6	32	1 3/8 34.9	31 5/8 803.3	399 181
28"	28.0 711.2	36 1/4 920.7		3 1/2 88.9	5 7/8 149.2	28 3/16 716.0	29 3/4 755.6	31 787.4	36	1 3/8 34.9	33 3/4 857.2	447 203
30"	30.0 762	39 990.6		3 11/16 93.7	3 7/32 158.0	30 1/4 768.4	32 812.8	33 1/4 844.5	36	1 1/2 38.1	36 1/4 920.7	590 268
32"	32.0 812.8	41 1/2 1054.1		4 1/16 103.2	6 5/8 168.3	32 1/4 819.2	34 863.6	35 1/2 901.7	32	1 5/8 41.3	38 1/2 977.9	727 330
34"	34.0 863.6	43 5/8 1108.1		4 1/16 103.2	6 13/16 173.0	34 1/4 869.9	36 1/8 917.6	37 1/2 952.5	36	1 5/8 41.3	40 5/8 1031.9	787 357
36"	36.0 914.4	46 1/8 1171.6		4 1/16 103.2	7 1/8 181.0	36 1/4 920.7	38 965.2	39 3/4 109.6	32	1 3/4 44.4	42 7/8 1089.0	893 405
42"	42.0 1066.8	52 1/2 1333.5		4 11/16 119.1	8 1/16 204.8	42 5/16 1074.7	44 1117.6	46 1168.4	36	1 7/8 47.6	49 1244.6	1252 568
48"	48.0 1219.2	59 1/2 1511.3		5 1/16 128.6	8 13/16 223.8	48 5/16 1227.1	50 5/16 1277.9	52 1/4 1327.1	40	2 55 3/4 50.8	1611 1416.0	731
54"	54.0 1371.6	55 7/8 1673.2		5 3/8 136.5	9 7/16 239.7	54 5/16 1379.5	56 1/2 1435.1	58 1/4 1479.5	48	2 62 1/8 50.8	1979 1578.0	898
60"	60.0 1524	73 15/16 1878.0		5 15/16 150.8	10 11/16 271.5	60 5/16 1531.9	62 15/16 1598.6	65 1651.0	40	2 3/8 60.3	69 7/16 1763.7	2890 1311

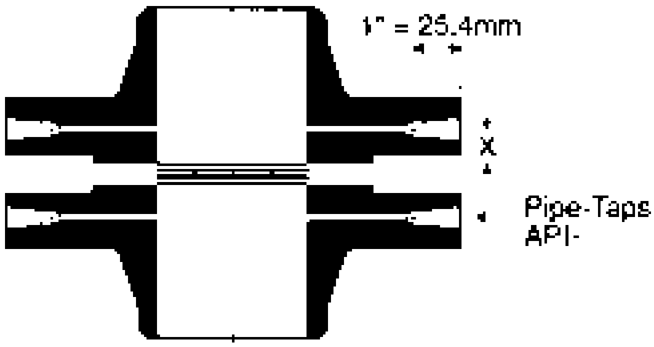


Nominal Pipe Size	Minimum Bore or tapping of Hub Flange	Nominal Pipe Size	Minimum Bore or tapping of Hub Flange	Nominal Pipe Size	Minimum Bore or tapping of Hub Flange
	3 1/2”	1 1/2”	3 1/2”	3 1/2”	
1”	1/2”	4”	1 1/2”	14”	4”
1 1/4”	1/2”	5”	1 1/2”	16”	4”
1 1/2”	1/2”	6”	2 1/2”	18”	4”
2”	1”	8”	3”	20”	4”
2 1/2”	1 1/4”	10”	3 1/2”		
3”	1 1/4”	12”		24”	4”

Reducing Flanges
Drilling, OD, Thickness and Facing Dimensions
Flange drilling, OD, thickness and facing are the same as those of the standard flange of the size from which the reduction is being made.

Hub Dimensions
Threaded and Slip-on Flanges
The hub dimensions shall be at least as large as those of the standard flange of the size to which the reduction is being made. The hub may be larger or omitted.

Welding Neck Flanges
The hub dimensions shall be the same as those of the standard flange of the size to which the reduction is being made.



Orifice flanges are manufactured in sizes from 1″ to 24″ as welding neck, slip-on or threaded flanges.
The two tap holes of each orifice flanges are provided with plugs.
All orifice flanges are drilled and machined for the installation of a jack screw.

Dimensions:

The dimensions are in accordance with those of the flanges standardized to ANSI B 16.5.

Tap Holes:

1/2″ API-thread for flanges class 300, 400 and 600.
3/4″ API-thread for flanges class 900 and 1500.

Tap hole diameters:

0.250″ for DN 2 1/2″ and smaller
0.375″ for DN 3″
0.500″ for DN 4″ and larger

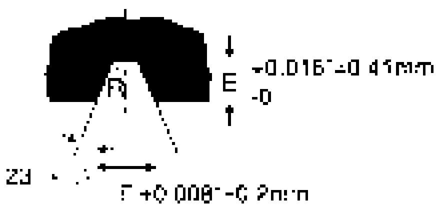
Distance of holes ″x″

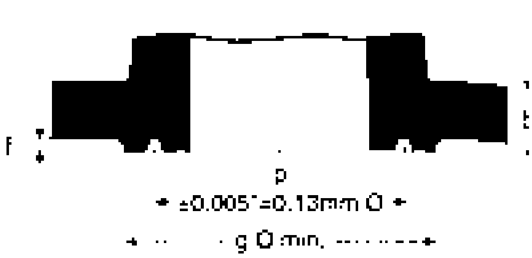
0.938″ for all flanges with raised faces.

The distance from the centerline of the tap hole to the face of the flange is 0.750″ for flanges ring type joint with a groove depth of 0.375″ and smaller. In case of a groove depth of 0.438″ and larger an alteration of the diameter or type of the tap hole is necessary.

Minimum flange thickness:

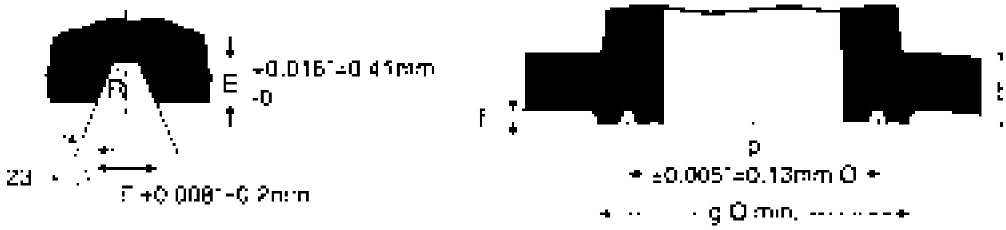
In order to obtain space for the tap holes the thickness of the flanges in the range of the small sizes is as follows:
1.500″ for raised face flanges class 300-600
1.375″ for raised face flanges class 900-1500
1.250″ for ring type joint flanges class 300-1500.





Nominal Size							Ring No.	Groove Dimensions				Diameter of Raised Face g				
150 lb/sq in	300 lb/sq in	400 lb/sq in	600 lb/sg in	900 lb/sq in	1500 lb/sq in	2500 lb/sq		Pitch Dia meter P	Depth E	Width F	Radius at Bottom max R	150 lb/sq in	300 400 600 lb/sq in	900 b/sq in	1500 b/sq in	2500 b/sq in
	1/2"	For sizes 1/2" to 3.1/2" data for 600 lb to be used.	1/2"	For sizes 1/2" to 2.1/2" data for 1500 lb to be used.			R11	1.344 34.1	0.219 5.6	0.281 7.1	0.03 0.8		2.00 50.8			
					1/2"		R12	1.562 39.7	0.250 6.4	0.344 8.7	0.03 0.8				2.38 60.5	
	3/4"		3/4"			1/2"	R13	1.688 42.9	0.250 6.4	0.344 8.7	0.03 0.8		2.50 63.5			2.56 65.0
					3/4"		R14	1.750 44.5	0.250 6.4	0.344 8.7	0.03 0.8				2.62 66.5	
1"							R15	1.875 47.6	0.250 6.4	0.344 8.7	0.03 0.08	2.50 63.5				
	1"		1"		1"	3/4"	R16	2.000 50.8	0.250 6.4	0.344 8.7	0.03 0.8		2.75 69.9		2.81 71.4	2.88 73.2
1 1/4"							R17	2.250 57.2	0.250 6.4	0.344 8.7	0.03 0.88	2.88 73.2				
	+1/4"		1 1/4"		1 1/4"	1"	R18	2.375 60.3	0.250 6.4	0.344 8.7	0.03 0.8		3.12 79.2		3.19 81.0	3.25 82.6
1 1/2"							R19	2.562 65.1	0.250 6.4	0.344 8.7	0.03 0.8	3.25 82.5				
	1 1/2"		1 1/2"		1 1/2"		R20	2.688 68.3	0.250 6.4	0.344 8.7	0.03 0.8		3.55 90.4		3.62 91.9	
						1 1/4"	R21	2.844 72.2	0.312 7.9	0.469 11.9	0.03 0.8					4.00 101.6
2"							R22	3.250 82.6	0.250 6.4	0.344 8.7	0.03 0.8	4.00 101.6				
	2"		2"			1 1/2"	R23	3.250 82.6	0.312 7.9	0.469 11.9	0.03 0.8		4.25 108.0			4.50 114.3
					2"		R24	3.750 95.3	0.312 7.9	0.469 11.9	0.03 0.8				4.88 124.0	
2 1/2"							R25	4.000 101.6	0.250 6.4	0.344 8.7	0.03 0.08	4.75 120.7				
2 1/2"			2 1/2"			2"	R26	4.000 101.6	0.312 7.9	0.460 11.9	0.03 0.8		5.00 127.0			5.25 133.4
					2 1/2"		R27	4.250 108.0	0.312 7.9	0.469 11.9	0.03 0.8				5.38 136.7	
						2 1/2"	R28	4.375 111.1	0.375 9.5	0.531 13.5	0.06 1.5					5.88 149.4

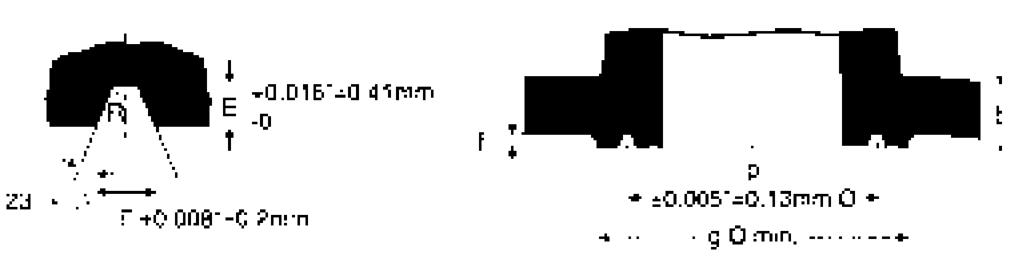
1) f= Height of raised portion and depth of grooved dimensions »E« but not covered by tolerances for »E«



Nominal Size							Ring No.	Groove Dimensions				Diameter of Raised Face g				
150 lb/sq in	300 lb/sq in	400 lb/sq in	600 lb/sg in	900 lb/sq in	1500 lb/sq in	2500 lb/sq		Pitch Dia meter P	Depth E	Width F	Radius at Bottom max R	150 lb/sq in	300 400 600 lb/sq in	900 b/sq in	1500 b/sq in	2500 b/sq in
3"		For sizes 1/2" to 3.1/2" data for 600 lb to be used.					R29	4.500 114.3	0.250 6.4	0.344 8.7	0.03 0.8	5.25 133.4				
	*)		*)				R30	4.625 117.5	0.312 7.9	0.469 11.9	0.03 0.8					
	*)3"		*)3"	3"			R31	4.875 123.8	0.312 7.9	0.469 11.9	0.03 0.8		5.75 146.1	6.12 155		
						3"	R32	5.000 127.0	0.375 9.5	0.531 13.5	0.06 0. 8					6.62 168.1
3 1/2"							R33	5.188 131.8	0.250 6.4	0.344 8.7	0.06 0.8	6.06 153.9				
	3 1/2"		3 1/2"				R34	5.188 131.8	0.312 7.9	0.469 11.9	0.03 0.8	6.25 158.8				
					3"		R35	5.375 136.5	0.312 7.9	0.469 11.9	0.03 0.8				6.62 168.1	
4"							R36	5.875 149.2	0.250 6.4	0.344 8.7	0.03 0.8	6.75 171.5				
	4"	4"	4"	4"			R37	5.875 149.2	0.312 7.9	0.469 11.9	0.03 0.8		6.88 174.8	7.12 180.8		
						4"	R38	6.188 157.2	0.438 11.1	0.656 16.7	0.06 1.5					8.00 203.2
					4"		R39	6.375 161.9	0.312 7.9	0.469 11.9	0.03 0.8			7.62 193.5		
5"							R40	6.750 149.2	0.250 6.4	0.344 8.7	0.03 0.8	7.75 171.5				
	5"	5"	5"	5"			R41	7.125 149.2	0.312 7.9	0.469 11.9	0.03 0.8		8.25 209.5	8.50 215.9		
						5"	R42	7.500 190.5	0.500 12.7	0.781 19.8	0.06 1.5					9.50 241.3
6"							R43	7.625 193.7	0250 6.4	0.344 8.7	0.03 0.8	8.62 218.9				
					5"		R44	7.625 193.7	0.312 7.9	0.4690 11.9	0.03 0.8				9.00 228.6	
	6"	6"	6"	6"			R45	8.312 211.1	0.312 7.9	0.469 11.9	0.03 0.8		9.50 241.3	9.50 241.3		

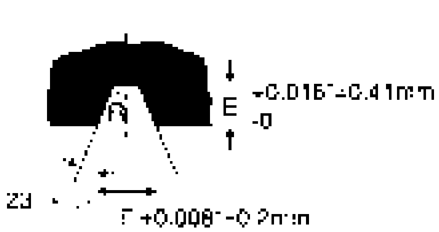
1) f= Height of raised portion and depth of grooved dimensions »E« but not covered by tolerances for »E«

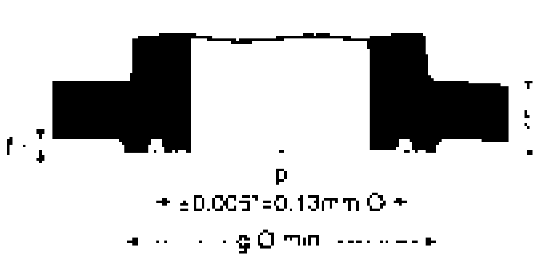
*) For ring joint with lapped flanges in the 300 and 600 lb standards, nng and groove number R 30 are used instead of R 31.



Nominal Size							Ring No.	Groove Dimensions				Diameter of Raised Face g				
150 lb/sq in	300 lb/sq in	400 lb/sq in	600 lb/sg in	900 lb/sq in	1500 lb/sq in	2500 lb/sq		Pitch Dia meter P	Depth E	Width F	Radius at Bottom max R	150 lb/sq in	300 400 600 lb/sq in	900 b/sq in	1500 b/sq in	2500 b/sq in
					6″		R46	8.312 211.1	0.375 9.5	0.531 13.5	0.06 1.5				9.75 247.7	
						6″	R47	9.000 228.6	0.500 12.7	0.781 19.8	0.06 1.5					11.0 279.4
8″							R48	9.750 247.7	0.450 6.4	0.344 8.7	0.03 0.8	10.75 273.1				
	8″	8″	8″	8″			R49	10.625 269.9	0.312 7.9	0.469 11.9	0.03 0.8		11.88 301.8	12.12 307.8		
					8″		R50	10.625 269.9	0.438 11.1	0.656 16.7	0.06 1.5				12.50 317.5	
						8″	R51	11.000 279.4	0.562 14.3	0.906 23.0	0.06 1.5					13.38 339.9
10″							R52	12.750 304.8	0.250 6.4	0.344 8.7	0.03 0.8	13.00 330.2				
	10″	10″	10″	10″			R53	12.750 323.9	0.312 7.9	0.469 11.9	0.03 0.8		14.00 355.6	14.25 362.0		
					10″		R54	12.750 323.9	0.438 11.1	0.656 16.7	0.06 1.5				14.62 371.5	
						10″	R55	13.500 342.90	0.688 17.5	1.188 30.2	0.09 2.30					16.75 425.5
12″							R56	15.000 381.0	0.250 6.4	0.344 8.7	0.03 0.8	16.00 406.4				
	12″	12″	12″	12″			R57	15.000 381.0	0.312 7.9	0.469 11.9	0.03 0.8		16.25 412.8	16.50 419.1		
					12″		R58	15.000 381.0	0.562 14.3	0.906 23.0	0.06 1.5				17.25 438.2	
14″							R59	15.625 396.9	0.250 6.4	0.344 8.7	0.03 0.8	16.75 425.5				
						12″	R60	16.000 406.4	0.688 17.5	1.312 33.30	0.09 2.3					19.50 495.3
	14″	14″	14″				R61	16.500 419.1	0.312 7.9	0.469 11.9	0.03 0.8		18.00 457.2			
				14″			R62	16.500 419.1	0.438 7.9	0.656 11.9	0.06 0.8			13.38 466.9		
					14″		R63	16.500 419.1	0.625 15.9	1.062 27.0	0.09 2.3				19.50 489.0	

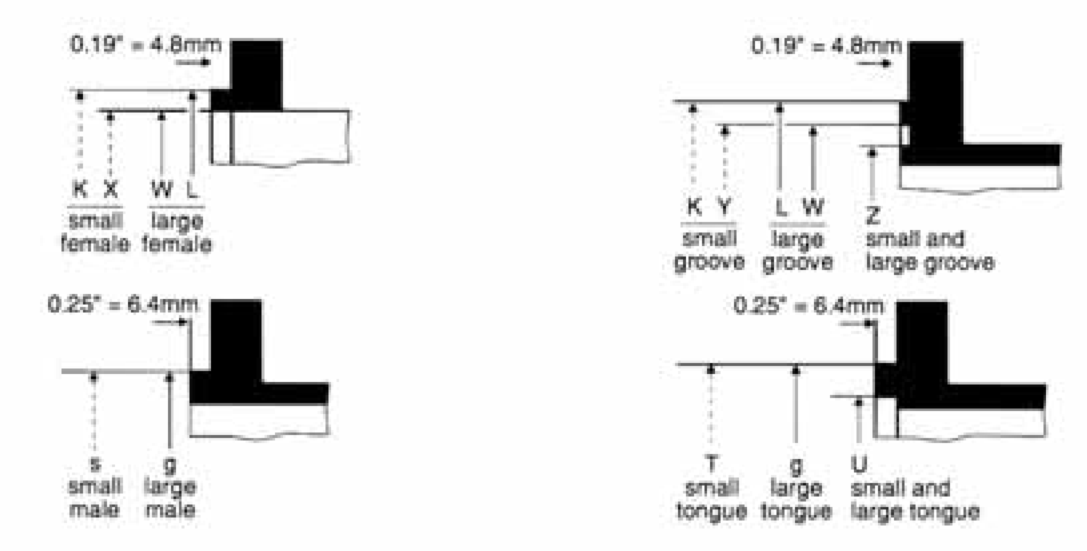
1) f= Height of raised portion and depth of grooved dimensions »E« but not covered by tolerances for »E«





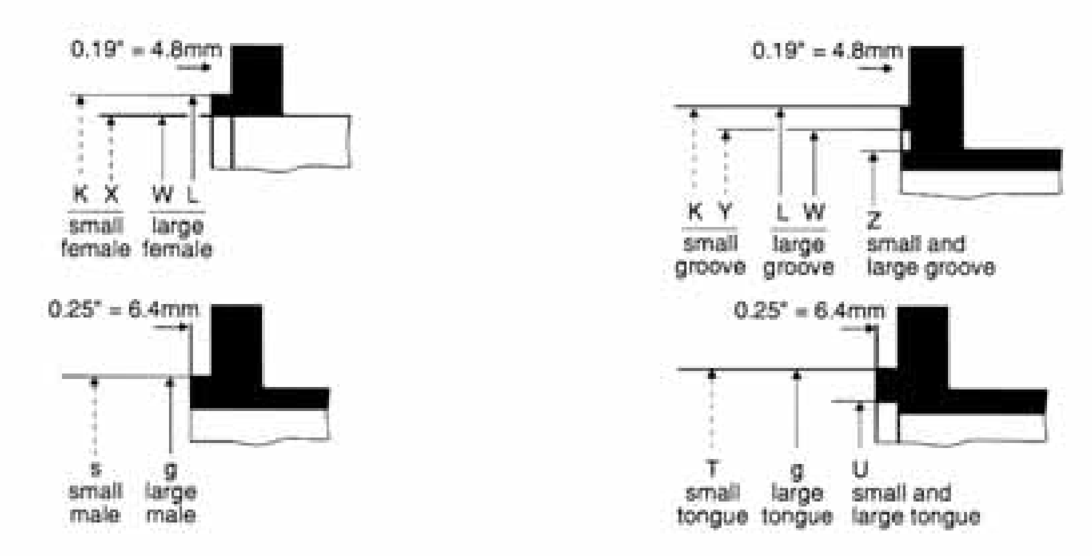
Nominal Size 150 lb/sq in	300 lb/sq in	400 lb/sq in	600 lb/sg in	900 lb/sq in	1500 lb/sq in	2500 lb/sq	Ring No.	Groove Dimensions Pitch Dia meter P	Depth E	Width F	Radius at Bottom max R	Diameter of Raised Face g 150 lb/sq in	300 400 600 lb/sq in	900 b/sq in	1500 b/sq in	2500 b/sq in
16″							R64	17.875	0.250	0.344	0.03	19.00				
								454.0	6.4	8.7	0.8	482.6				
	16″	16″	16″				R65	18.500	0.312	0.469	0.03		20.00			
								469.9	7.9	11.9	0.8		508.0			
				16″			R66	18.500	0.438	0.656	0.06			20.62		
								469.9	11.1	16.7	1.5			523.7		
					16″		R67	18.500	0.688	1.188	0.09				21.50	
								469.9	11.1	16.7	1.5			523.7		
18″							R68	20.375	0.250	0.344	0.03	21.50				
								517.5	6.4	8.7	0.8	546.1				
	18″	18″	18″				R69	21.000	0.312	0.469	0.03		22.62			
								533.4	7.9	11.9	0.8		574.5			
				18″			R70	21.000	0.500	0.781	0.06			23.38		
								533.4	12.7	19.8	1.5			593.9		
					18″		R71	21.000	0.688	1.188	0.09				24.12	
								533.4	17.5	30.2	2.3				612.6	
20″							R72	22.000	0.250	0.344	0.03	23.50				
								558.86	6.4	8.7	0.8	596.9				
	20″	20″	20″				R73	23.000	0.375	0.531	0.06		25.00			
								584.2	9.5	13.5	1.5		635.0			
				20″			R74	23.000	0.500	0.781	0.06			25.50		
								584.2	12.7	19.8	1.5			647.7		
					20″		R75	23.000	0.688	1.312	0.09				26.50	
								584.2	17.5	33.3	2.3				673.1	
24″							R76	26.500	0.250	0.344	0.03	28.20				
								673.1	6.4	8.7	0.8	711.2				
	24″	24″	24″				R77	27.250	0.438	0.656	0.06		29.50			
								692.2	11.1	16.7	1.5		749.3			
				24″			R78	27.250	0.625	1.062	0.09			30.38		
								692.2	15.9	27.0	2.3			771.7		
					24″		R79	27.250	0.812	1.438	0.09				31.75	
								692.2	20.6	36.50	2.3				793.8	

1) f= Height of raised portion and depth of grooved dimensions »E« but not covered by tolerances for »E«



Nom. Pipe Size	Outside Diameter			Inside Dia. of Large and Small Tongue	Outside Diameter			Inside Diam. of Large and Small Groove	Diameter of Raised Face min.	
	Large Male and Large Tongue g	Small Male S	Small Tongue T	U	Large Female and Large W	Small Female X	Small Groove Y	Z	Small Female and Groove K	Large Female and Groove L
1/2"	1.38	0.72	1.38	1.00	1.44	0.78	1.44	0.94	1.75	1.81
	35.1	18.3	35.1	25.4	36.61	19.8	36.6	23.9	44.5	46.0
3/4"	1.69	0.94	1.69	1.31	1.75	1.00	1.75	1.25	2.06	2.12
	42.9	23.9	42.9	33.3	44.5	25.4	44.5	31.8	52.3	53.8
1"	2.00	1.19	1.88	1.50	2.06	1.25	1.94	1.44	2.25	2.44
	50.8	30.2	47.8	38.1	52.3	31.8	49.3	36.6	57.2	62.0
11/4"	2.50	1.50	2.25	1.88	2.56	1.56	2.31	1.81	2.62	2.94
	63.5	38.1	57.2	47.8	65.0	39.6	58.7	46.0	66.5	74.7
11/2"	2.88	1.75	2.50	2.12	2.94	1.81	2.56	2.06	2.88	3.31
	73.2	44.5	63.5	53.8	74.7	46.0	65.0	52.3	73.2	84.1
2"	3.62	2.25	3.25	2.88	3.69	2.31	3.31	2.81	3.62	4.06
	91.9	57.2	82.6	73.2	93.7	58.7	84.1	71.4	91.9	103.1
21/2"	4.12	2.69	3.75	3.38	4.19	2.75	3.81	3.31	4.12	4.56
	104.6	68.3	95.3	85.9	106.4	69.9	96.8	84.1	104.6	115.8
3"	5.00	3.31	4.62	4.25	5.06	3.38	4.69	4.19	5.00	5.44
	127.0	84.1	117.3	108.0	128.5	85.9	119.1	106.4	127.0	138.2
31/2"	5.50	3.81	5.12	4.75	5.56	3.88	5.19	4.69	5.50	5.94
	139.7	96.8	130.0	120.7	141.2	98.6	131.8	119.1	139.7	150.9
4"	6.19	4.31	5.69	5.19	6.25	4.38	5.75	5.12	6.19	6.62
	157.2	109.5	144.5	131.8	158.8	111.3	146.1	130.0	157.2	168.1

Large male and female face and large tongue and groove are not applicable to Class 150 because of potential dimensional conflicts.

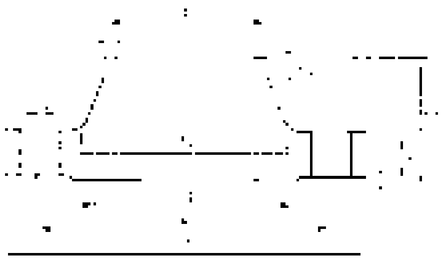


Nom. Pipe Size	Outside Diameter			Inside Dia. of Large and Small Tongue	Outside Diameter			Inside Diam. of Large and Small Groove	Diameter of Raised Face min.	
	Large Male and Large Tongue g	Small Male S	Small Tongue T	U	Large Female and Large W	Small Female X	Small Groove Y	Z	Small Female and Groove K	Large Female and Groove L
5″	7.31 185.7	5.38 136.7	6.81 173.0	6.31 160.3	7.38 187.5	5.44 138.2	6.88 174.8	6.25 158.8	7.31 185.7	7.75 196.9
6″	8.50 215.9	6.38 162.1	8.00 203.2	7.50 190.5	8.56 217.4	6.44 163.6	8.06 204.7	7.44 189.0	8.50 215.9	8.94 227.1
8″	10.62 269.7	8.38 212.9	10.00 254.0	9.38 238.3	10.69 217.5	8.44 214.4	10.06 255.5	9.31 236.5	10.62 269.7	11.06 280.9
10″	12.75 323.9	10.50 266.7	12.00 304.8	11.25 285.8	12.81 325.4	10.56 268.3	12.06 306.3	11.19 284.2	12.75 323.9	13.19 335.0
12″	15.00 381.0	12.50 317.5	14.25 362.0	13.50 342.9	15.06 382.5	12.56 319.0	14.31 363.5	13.44 341.4	15.00 381.0	15.44 392.2
14″	16.25 412.8	13.75 349.3	15.50 393.7	14.75 374.7	16.31 414.3	13.81 350.8	15.56 395.2	14.69 373.1	16.25 412.8	16.69 423.9
16″	18.50 469.9	15.75 400.1	17.62 447.5	16.75 425.5	18.56 471.4	15.81 401.6	17.69 449.3	16.69 423.9	18.50 469.9	18.94 481.1
18″	21.00 533.4	17.75 450.9	20.12 511.0	19.25 489.0	21.06 534.9	17.81 452.4	20.19 512.8	19.19 487.4	21.00 533.4	21.44 544.6
20″	23.00 584.2	19.75 501.7	22.00 558.8	21.00 533.4	23.06 585.7	19.81 503.2	22.06 560.3	20.94 531.9	23.00 584.2	23.44 595.4
24″	27.25 692.2	23.75 603.3	26.25 666.8	25.25 641.4	27.31 693.7	23.81 604.8	26.31 668.3	25.19 639.8	27.25 692.2	27.69 703.3

Large male and female face and large tongue and groove are not applicable to Class 150 because of potential dimensional conflicts.

Flanges corresponding to German standards for tubing and piping to DIN and ISO

Types of flange	DIN-tables, pressure and nominal widths					
Welding neck Flanges	2631 (PN 6) DN 10-100	2632 (PN 10) DN 10-100	2633 (PN 16) DN 10-100	2634 (PN 25) DN 10-100	2635 (PN 40) DN 10-500	2636 (PN 64) DN 10-400	
	2637 (PN 160) DN 10-350	2638 (PN 160) DN 10-300	2628 (PN 250) DN 10-250	2629 (PN 320) DN 10-250	2627 (PN 400) DN 10-200		
Block Flanges	28117 (PN 10-40) DN 15-500						
Plain Flanges and threaded flanges	2573 (PN 6) DN 10-500	2576 (PN 10) DN 10-500	2566 (PN 10-16) DN 6-100				
Plain Collars with loose langes	2641 (PN 6) DN 10-1000	2642 (PN 10) DN 10-800	2655 (PN 25) DN 200-500	2656 (PN 40) DN 10-400			
Welding neck Collars with loose Flanges	2673 (PN 10) DN 10-1000	2674 (PN 16) DN 10-500	2675 (PN 25) DN 200-500	2676 (PN 40) DN 10-500			
Seamless long/Welding neck for pressure vessels	28115 (PN 10-40) DN 25-500	28031 DN 300-1100	28032 DN 300-1100	28034 DN 300-1100	28036 DN 300-1100	28038 DN 1000-1100	
	2527 (PN 6)	2527 (PN 10)	2527 (PN 16)	2527 (PN 25)	2527 (PN 40)	2527 (PN 64)	2527 (PN 100)
Blind Flanges	DN 10-300	DN 200-500	DN 10-500	DN 175-500	DN 10-500	DN 50-400	DN 10-350

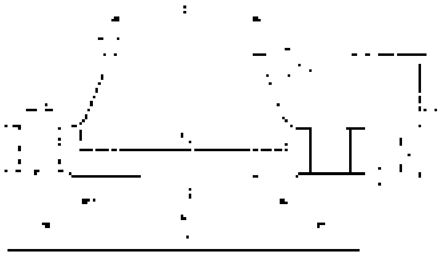


Nominal Bore			Flange				Meck				RF		Stud Bolt			Weight of
NB	d1												pc.	thread	D2	a Flange
	Part 1	Part 2	D	b	k	h1	d3	s	r	h2	d4	f				(7,85 kg/dm3)
10	-	14	75	12	50	28	22	1.8	4	6	35	2	4	M10	11	0.335
10	17.2	-	75	12	50	28	26	1.8	4	6	35	2	4	M10	11	0.335
15	-	20	80	12	55	30	28	2	4	6	40	2	4	M10	11	0.392
15	21.3	-	80	12	55	30	30	2	4	6	40	2	4	M10	11	0.392
20	-	25	90	14	65	32	35	2.3	4	6	50	2	4	M10	11	0.592
20	26.9	-	90	14	65	32	38	2.3	4	6	50	2	4	M10	11	0.592
25	-	30	100	14	75	35	40	2.6	4	6	60	2	4	M10	11	0.747
25	33.7	-	100	14	75	35	42	2.6	4	6	60	2	4	M10	11	0.747
32	-	38	120	14	90	35	50	2.6	6	6	70	2	4	M12	14	1.050
32	42.4	-	120	14	90	35	55	2.6	6	6	70	2	4	M12	14	1.050
40	-	44.5	130	14	100	38	58	2.6	6	7	80	3	4	M12	14	1.180
40	48.3	-	130	14	100	38	62	2.6	6	7	80	3	4	M12	14	1.180
50	-	57	140	14	110	38	70	2.9	6	8	90	3	4	M12	14	1.340
50	60.3	-	140	14	110	38	74	2.9	6	8	90	3	4	M12	14	1.340
65	76.1	-	160	14	130	38	88	2.9	6	9	110	3	4	M12	14	1.670
80	88.9	-	190	16	150	42	102	3.2	8	10	128	3	4	M16	18	2.710
100	-	108	210	16	170	45	122	3.6	8	10	148	3	4	M16	18	3.240
100	114.3	-	210	16	170	45	130	3.6	8	10	148	3	4	M16	18	3.240
125	-	133	240	18	200	48	148	4	8	10	178	3	8	M16	18	4.490
125	139.7	-	240	18	200	48	155	4	8	10	178	3	8	M16	18	4.490
150	-	159	265	18	225	48	172	4.5	10	12	202	3	8	M16	18	5.150
150	168.3	-	265	18	225	48	184	4.5	10	12	202	3	8	M16	18	5.150
200	219.1	-	320	20	280	55	236	5.9	10	15	258	3	8	M16	18	7.780
250	-	267	375	22	335	60	282	6.3	12	15	312	3	12	M16	18	10.80
250	273	-	375	22	335	60	290	6.3	12	15	312	3	12	M16	18	10.80
300	323.9	-	440	22	395	62	342	7.1	12	15	365	4	12	M20	22	14.00
350	355.6	-	490	22	445	62	385	7.1	12	15	415	4	12	M20	22	18.50
350	-	368	490	22	445	62	385	7.1	12	15	415	4	12	M20	22	16.70
400	406.4	-	540	22	495	65	438	7.1	12	15	465	4	16	M20	22	21.20
400	-	419	540	22	495	65	438	7.1	12	15	465	4	16	M20	22	19.00
500	508	-	645	24	600	68	538	7.1	12	15	570	4	20	M20	22	28.60
600	610	-	755	24	705	70	640	7.1	12	16	670	5	20	M24	26	31.50
700	711	-	860	24	810	70	740	7.1	12	16	775	5	24	M24	26	37.40
800	813	-	975	24	920	70	842	7.1	12	16	880	5	24	M27	30	46.10
900	914	-	1075	26	1020	70	942	7.1	12	16	980	5	24	M27	30	55.60
1000	1016	-	1175	26	1120	70	1045	7.1	16	16	1080	5	28	M27	30	61.90
1200	1220	-	1405	28	1340	90	1248	8	16	20	1295	5	32	M30	33	100.0
1400	1420	-	1630	32	1560	90	1452	8	16	20	1510	5	36	M33	36	149.0
1600	1620	-	1830	34	1760	90	1655	9	16	20	1710	5	40	M33	36	180.0
1800	1820	-	2045	36	1970	100	1855	10	16	20	1920	5	44	M36	39	225.0
2000	2020	-	2265	38	2180	110	2058	11	16	25	2125	5	48	M39	42	295.0
2200	2220	-	2475	42	2390	115	2260	12	18	25	2335	6	52	M39	42	361.0
2400	2420	-	2685	44	2600	125	2462	13	18	25	2545	6	56	M39	42	415.0
2600	2620	-	2905	46	2810	130	2665	14	18	25	2750	6	60	M45	48	530.0
2800	2820	-	3115	48	3020	135	2865	15	18	30	2960	6	64	M45	48	643.0
3000	3020	-	3315	50	3220	140	3068	16	18	30	3160	6	68	M45	48	777.0
3200	3220	-	3525	54	3430	150	3272	16	20	30	3370	6	72	M45	48	851.0
3400	3420	-	3735	56	3640	160	3475	18	20	35	3580	6	76	M45	48	993.0
3600	3620	-	3970	60	3860	165	3678	18	20	35	3790	6	80	M52	56	1001

The values in Part 2 are applicable for German standard.

Weld-Neck-Flange

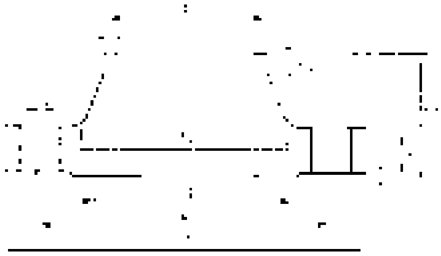
DIN 2632 PN 10



Nominal Bore			Flange				Meck				RF		Stud Bolt			Weight of a Flange
NB	d1 Part 1	Part 2	D	b	k	h1	d3	s	r	h2	d4	f	pc.	thread	D2	(7,85 kg/dm3)
200	219.1	-	340	24	295	62	235	5.9	10	16	268	3	8	M20	22	11.3
250	-	267	395	26	350	68	285	6.3	12	16	320	3	12	M20	22	14.7
250	273	-	395	26	350	68	292	6.3	12	16	320	3	12	M20	22	14.7
300	323.9	-	445	26	400	68	344	7.1	12	16	370	4	12	M20	22	17.4
350	355.6	-	505	26	460	68	385	7.1	12	16	430	4	16	M20	22	23.6
350	-	368	505	26	460	68	385	7.1	12	16	430	4	16	M20	22	21.6
400	406.4	-	565	26	515	72	440	7.1	12	16	482	4	16	M24	26	28.6
400	-	419	565	26	515	72	440	7.1	12	16	482	4	16	M24	26	26.2
500	508	-	670	28	620	75	542	7.1	12	16	585	4	20	M24	26	38.1
600	610	-	780	28	725	80	642	7.1	12	18	685	5	20	M27	30	44.6
700	711	-	895	30	840	80	745	8	12	18	800	5	24	M27	30	62.4
800	813	-	1015	32	950	90	850	8	12	18	905	5	24	M30	33	84.1
900	914	-	1115	34	1050	95	950	10	12	20	1005	5	28	M30	33	98.5
1000	1016	-	1230	34	1160	95	1052	10	16	20	1110	5	28	M33	36	115.0
1200	1220	-	1455	38	1380	115	1255	11	16	25	1330	5	32	M36	39	182.0
1400	1420	-	1675	42	1590	120	1460	12	16	25	1535	5	36	M39	42	248.0
1600	1620	-	1915	46	1820	130	1665	14	16	25	1760	5	40	M45	48	347.0
1800	1820	-	2115	50	2020	140	1868	15	16	30	1960	5	44	M45	48	430.0
2000	2020	-	2325	54	2230	150	2072	16	16	30	2170	5	48	M45	48	539.0
2200	2220	-	2550	58	2440	160	2275	18	18	35	2370	6	52	M52	56	658.0
2400	2420	-	2760	62	2650	170	2478	20	18	35	2570	6	56	M52	56	825.0
2600	2620	-	2960	66	2850	180	2680	22	18	40	2780	6	60	M52	56	979.0
2800	2820	-	3180	70	3070	190	2882	22	18	40	3000	6	64	M52	56	1156.0
3000	3020	-	3405	75	3290	200	3085	24	18	45	3210	6	68	M56	62	1402.0

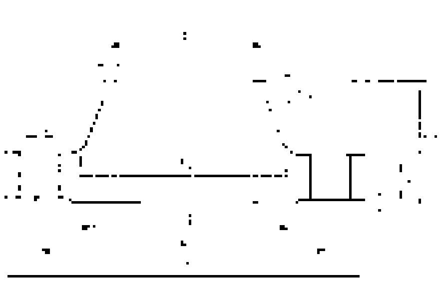
From NB 10 up to NB 150 Weld-Neck-Flange acc.to DIN 2633, use nomimal pressure 16.
The values in Part 2 are applicable for German standards.

The values in Part 2 are applicable for German standard.



Nominal Bore			Flange				Meck				RF		Stud Bolt			Weight of
NB	d1												pc.	thread	D2	a Flange
	Part 1	Part 2	D	b	k	h1	d3	s	r	h2	d4	f				(7,85 kg/dm3)
10	-	14	90	14	60	35	25	1.8	4	6	40	2	4	M12	14	0.580
10	17.2	-	90	14	60	35	28	1.8	4	6	40	2	4	M12	14	0.580
15	-	20	95	14	65	35	30	2	4	6	45	2	4	M12	14	0.648
15	21.3	-	95	14	65	35	32	2	4	6	45	2	4	M12	14	0.648
20	-	25	105	16	75	38	38	2.3	4	6	58	2	4	M12	14	0.952
20	26.9	-	105	16	75	38	40	2.3	4	6	58	2	4	M12	14	0.952
25	-	30	115	16	85	38	42	2.6	4	6	68	2	4	M12	14	1.140
25	33.7	-	115	16	85	38	45	2.6	4	6	68	2	4	M12	14	1.140
32	-	38	140	16	100	40	52	2.6	6	6	78	2	4	M16	18	1.690
32	42.4	-	140	16	100	40	56	2.6	6	6	78	2	4	M16	18	1.690
40	-	44.5	150	16	110	42	60	2.6	6	7	88	3	4	M16	18	1.860
40	48.3	-	150	16	110	42	64	2.6	6	7	88	3	4	M16	18	1.860
50	-	57	465	18	125	45	72	2.9	6	8	102	3	4	M16	18	2.530
50	63.3	-	165	18	125	45	75	2.9	6	8	102	3	4	M16	18	2.530
65	76.1	-	185	18	145	45	90	2.9	6	10	122	3	4	M16	18	3.060
80	88.9	-	200	20	160	50	105	3.2	8	10	138	3	8	M16	18	3.700
100	-	108	220	20	180	52	125	3.6	8	12	158	3	8	M16	18	4.620
100	114.3	-	220	20	180	52	131	3.6	8	12	158	3	8	M16	18	4.620
125	-	133	250	22	210	55	150	4	8	12	188	3	8	M16	18	6.300
125	139.7	-	250	22	210	55	156	4	8	12	188	3	8	M16	18	6.300
150	-	159	285	22	240	55	175	4.5	10	12	212	3	8	M20	22	7.750
150	168.3	-	285	22	240	55	184	4.5	10	12	212	3	8	M20	22	7.750
175	193.7	-	315	24	270	60	210	5.4	10	12	242	3	8	M20	22	9.850
200	219.1	-	340	24	295	62	235	5.9	10	16	268	3	12	M20	22	11.00
250	-	267	405	26	355	70	285	6.3	12	16	320	3	12	M24	26	15.60
250	273	-	405	26	355	70	292	6.3	12	16	320	3	12	M24	26	15.60
300	323.9	-	460	28	410	78	344	7.1	12	16	378	4	12	M24	26	22.00
350	355.6	-	520	30	470	82	390	8	12	16	438	4	16	M24	26	31.20
350	-	368	520	30	470	82	390	8	12	16	438	4	16	M24	26	28.80
400	406.4	-	580	32	525	85	445	8	12	16	490	4	16	M27	30	39.30
500	508	-	715	34	650	90	548	8	12	16	610	4	20	M30	33	61.00
600	610	-	840	36	770	95	652	8.8	12	18	725	5	20	M33	36	75.40
700	711	-	910	36	840	100	755	8.8	12	18	795	5	24	M33	36	77.00
800	813	-	1025	38	950	105	855	10	12	20	900	5	24	M36	39	101.0
900	914	-	1125	40	1050	110	955	10	12	20	1000	5	28	M36	39	122.0
1000	1016	-	1255	42	1170	120	1058	10	16	22	1115	5	28	M39	42	162.0
1200	1220	-	1485	48	1390	130	1262	12.5	16	30	1330	5	32	M45	48	243.0
1400	1420	-	1685	52	1590	145	1465	14.2	16	30	1530	5	36	M45	48	323.0
1600	1620	-	1930	58	1820	160	1668	16	16	35	1750	5	40	M52	56	479.0
1800	1820	-	2130	62	2020	170	1870	17.5	16	35	1950	5	44	M52	56	599.0
2000	2020	-	2345	66	2230	180	2072	20	16	40	2150	5	48	M56	62	719.0

The values in Part 2 are applicable for German standards.



Nominal Bore			Flange				Meck				RF		Stud Bolt			Weight of
NB	d1												pc.	thread	D2	a Flange
	Part 1	Part 2	D	b	k	h1	d3	s	r	h2	d4	f				(7,85 kg/dm3)
175	193	-	330	28	280	75	218	5.6	10	15	248	3	12	M24	26	13.40
200	219.1	-	360	30	310	80	244	6.3	10	16	278	3	12	M24	26	17.00
250	-	267	425	32	370	88	292	7.1	12	18	335	3	12	M27	30	24.40
-	273	-	425	32	370	88	298	7.1	12	18	335	3	12	M27	30	24.40
300	323.9	-	485	34	430	92	352	8	12	18	395	4	16	M27	30	31.20
350	355.6	-	555	38	490	100	398	8	12	20	450	4	16	M30	33	47.20
-	-	368	555	38	490	100	398	8	12	20	450	4	16	M30	33	44.20
400	406.4	-	620	40	550	110	452	8.8	12	20	505	4	16	M33	36	61.70
-	-	419	620	40	550	110	452	8.8	12	20	505	4	16	M33	36	57.90
500	508	-	730	44	660	125	558	10	12	20	615	4	20	M33	36	89.60
600	510	-	845	46	770	125	660	11	12	20	720	5	20	M36	39	104.0
700	711	-	960	46	875	125	760	12.5	12	20	820	5	24	M39	42	136.0
800	813	-	1085	50	990	135	865	14.2	12	22	930	5	24	M45	48	186.0
900	914	-	1185	54	1090	145	968	16	12	24	1030	5	28	M45	48	236.0
1000	1016	-	1320	58	1210	155	1070	17.5	16	24	1140	5	28	m52	56	307.0

From NB 10 up to NB 150 Weld-neck-Flange to DIN 2635, use nomincal pressure 40.
The values in Part 2 are applicable for German standards.

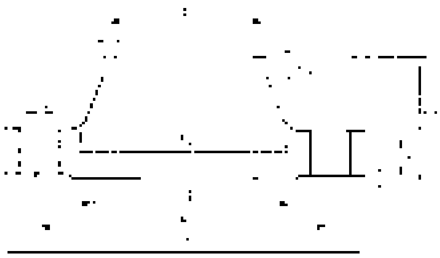
Weld-Neck-Flange

DIN 2635 PN 40



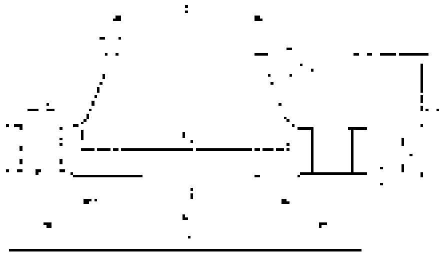
Nominal Bore			Flange				Meck				RF		Stud Bolt			Weight of
NB	d1												pc.	thread	D2	a Flange
	Part 1	Part 2	D	b	k	h1	d3	s	r	h2	d4	f				(7,85 kg/dm3)
10	-	14	90	16	60	35	25	1.8	4	6	40	2	4	M12	14	0.661
10	17.2	-	90	16	60	35	28	1.8	4	6	40	2	4	M12	14	0.661
15	-	20	95	16	65	38	30	2	4	6	45	2	4	M12	14	0.746
15	21.3	-	95	16	65	38	32	2	4	6	45	2	4	M12	14	0.746
20	-	25	105	18	75	40	38	2.3	4	6	58	2	4	M12	14	1.060
20	26.9	-	105	18	75	40	40	2.3	4	6	58	2	4	M12	14	1.060
25	-	30	115	18	85	40	42	2.6	4	6	68	2	4	M12	14	1.290
25	33.7	-	115	18	85	40	46	2.6	4	6	68	2	4	M12	14	1.290
32	-	38	140	18	100	42	52	2.6	6	6	78	2	4	M16	18	1.880
32	42.4	-	140	18	100	42	56	2.6	6	6	78	2	4	M16	18	1.880
40	-	44.5	150	18	110	45	60	2.6	6	7	88	3	4	M16	18	2.330
40	48.3	-	150	18	110	45	64	2.6	6	7	88	3	4	M16	18	2.330
50	-	57	165	20	125	48	72	2.9	6	8	102	3	4	M16	18	2.820
50	60.3	-	165	20	125	48	75	2.9	6	8	102	3	4	M16	18	2.820
65	76.1	-	185	22	145	52	90	2.9	6	10	122	3	8	M16	18	3.740
80	88.9	-	200	24	160	58	105	3.2	8	12	138	3	8	M16	18	4.750
100	108	235	235	24	190	65	128	3.6	8	12	162	3	8	M20	22	6.520
100	114.3	-	235	24	190	65	134	3.6	8	12	162	3	8	M20	22	6.520
125	-	133	270	26	220	68	155	4	8	12	188	3	8	M24	26	9.070
125	139.7	-	270	26	220	68	162	4	8	12	188	3	8	M24	26	9.070
150	-	159	300	28	250	75	182	4.5	10	12	218	3	8	M24	26	11.80
150	168.3	-	300	28	250	75	192	4.5	10	12	218	3	8	M24	26	11.80
(175)	193.7	-	350	32	295	82	218	5.6	10	15	260	3	12	M27	30	18.20
200	219.1	-	375	34	320	88	244	6.3	10	16	285	3	12	M27	30	21.50
250	-	267	450	38	385	105	298	7.1	12	18	345	3	12	M30	33	34.90
250	273	-	450	38	385	105	306	7.1	12	18	345	3	12	M30	33	34.90
300	323.9	-	515	42	450	115	362	8	12	18	410	4	16	M30	33	49.70
350	355.6	-	580	46	510	125	408	8.8	12	20	465	4	16	M33	36	68.10
350	-	368	580	46	510	125	408	8.8	12	20	465	4	16	M33	36	68.10
400	406.4	-	660	50	585	135	462	11	12	20	535	4	16	M36	39	96.50
400	-	419	660	50	585	135	462	11	12	20	535	4	16	M36	39	96.50
500	508	-	755	52	670	140	562	14.2	12	20	615	4	20	M39	42	117.0

The values in Part 2 are applicable for Germany standards.



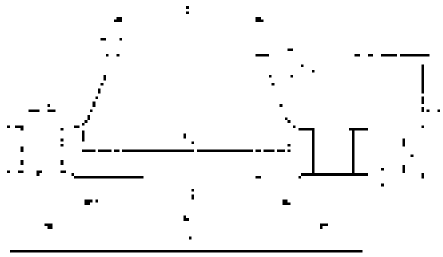
Nominal Bore			Flange				Meck				RF		Stud Bolt			Weight of
NB	d1 Part 1	Part 2	D	b	k	h1	d3	s	r	h2	d4	f	pc.	thread	D2	a Flange (7,85 kg/dm3)
50	-	57	180	26	135	62	78	2.9	6	10	102	3	4	M20	22	4.550
	60.3	-	180	26	135	62	82	2.9	6	10	102	3	4	M20	22	4.550
65	76.1	-	205	26	160	68	98	3.2	6	12	122	3	8	M20	22	5.730
80	88.9	-	215	28	170	72	112	3.6	8	12	138	3	8	M20	22	6.690
100	-	108	250	30	200	78	132	4	8	12	162	3	8	M24	26	9.660
	114.3	-	250	30	200	78	138	4	8	12	162	3	8	M24	26	9.660
125	-	133	295	34	240	88	162	4.5	8	12	188	3	8	M27	30	15.10
	139.7	-	295	34	240	88	168	4.5	8	12	188	3	8	M27	30	15.10
150	-	159	345	36	280	95	192	5.6	10	12	218	3	8	M30	33	21.90
	168.3	-	345	36	280	95	202	5.6	10	12	218	3	8	M30	33	21.90
(175)	193.7	-	375	40	310	105	228	6.3	10	16	260	3	12	M30	33	23.70
200	219.1	-	415	42	345	110	256	7.1	10	16	285	3	12	M33	36	34.90
250	-	267	470	46	400	125	310	8.8	12	18	345	3	12	M33	36	49.60
	273	-	470	46	400	125	316	8.8	12	18	345	3	12	M33	36	49.60
300	323.9	-	530	12	460	140	372	11	12	18	410	4	16	M33	36	68.70
350	355.6	-	600	56	525	150	420	12.5	12	20	465	4	16	M36	39	94.60
	-	368	600	56	525	150	420	12.5	12	20	465	4	16	M36	39	94.60
400	406.4	-	670	60	585	160	475	14.2	12	20	535	4	16	M39	42	124.0
	-	419	670	60	585	160	475	14.2	12	20	535	4	16	M39	42	124.0

The values in Part 2 are applicable for German standards.



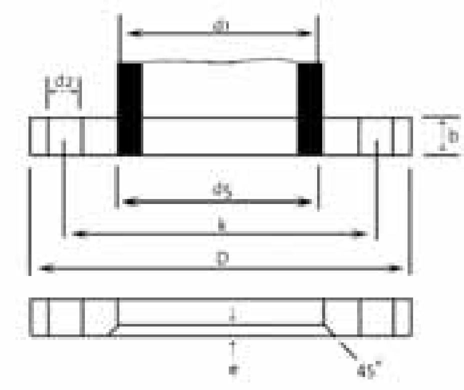
Nominal Bore			Flange				Meck				RF		Stud Bolt			Weight of
NB	d1 Part 1	Part 2	D	b	k	h1	d3	s	r	h2	d4	f	pc.	thread	D2	a Flange (7,85 kg/dm3)
10	-	14	100	20	70	45	28	1.8	4	6	40	2	4	M12	14	1.090
	17.2	-	100	20	70	45	32	1.8	4	6	40	2	4	M12	14	1.090
15	-	20	105	20	75	45	32	2	4	6	45	2	4	M12	14	1.190
	21.3	-	105	20	75	45	34	2	4	6	45	2	4	M12	14	1.190
25	-	30	140	24	100	58	48	2.6	4	8	68	2	4	M16	18	2.660
	33.7	-	140	24	100	58	52	2.6	4	8	68	2	4	M16	18	2.660
40	-	44.5	170	26	125	62	65	2.9	6	10	88	3	4	M20	22	4.090
	48.3	-	170	26	125	62	70	2.9	6	10	88	3	4	M20	22	4.090
50	-	57	195	28	145	68	86	3.2	6	10	102	3	4	M24	26	5.980
	60.3	-	195	28	145	68	90	3.2	6	10	102	3	4	M24	26	5.980
65	76.1	-	220	30	170	76	108	3.6	6	12	122	3	8	M24	26	7.910
80	88.9	-	230	32	180	78	120	4	8	12	138	3	8	M24	26	8.950
100	-	108	265	36	210	90	145	5	8	12	162	3	8	M27	30	13.70
	114.3	-	265	36	210	90	150	5	8	12	162	3	8	M27	30	13.70
125	-	133	315	40	250	105	180	6.3	8	12	188	3	8	M30	33	22.70
	139.7	-	315	40	250	105	180	6.3	8	12	188	3	8	M30	33	22.70
150	-	159	355	44	290	115	210	7.1	10	12	218	3	12	M30	33	30.20
	168.3	-	355	44	290	115	210	7.1	10	12	218	3	12	M30	33	30.20
175	193.7	-	385	48	320	127	245	8.8	10	16	260	3	12	M30	33	38.90
200	219.1	-	430	52	360	130	278	10	10	16	285	3	12	M33	36	52.80
250	-	267	505	60	430	157	340	12.5	12	18	345	3	12	M36	39	81.40
	273	-	505	60	430	157	340	12.5	12	18	345	3	12	M36	39	81.40
300	323.9	-	585	68	500	170	400	14.2	12	18	410	4	16	M39	42	122.0
350	355.6	-	655	74	560	189	460	16	12	20	465	4	16	M45	48	165.0
	-	368	655	74	560	189	460	16	12	20	465	4	16	M45	48	165.0

The values in Part 2 are applicable for German standards.

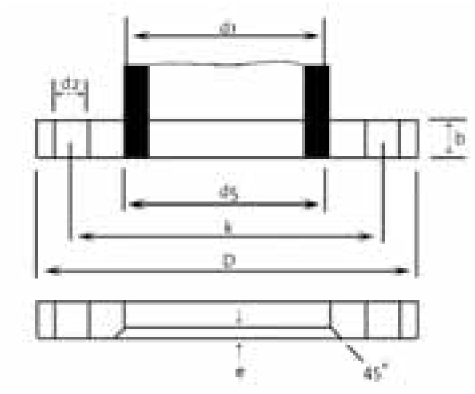


Nominal Bore			Flange				Meck				RF		Stud Bolt			Weight of
NB	d1												pc.	thread	D2	a Flange
	Part 1	Part 2	D	b	k	h1	d3	s	r	h2	d4	f				(7,85 kg/dm3)
10	-	14	100	20	70	45	28	2	4	6	40	2	4	M12	14	1.090
10	17.2	-	100	20	70	45	32	2	4	6	40	2	4	M12	14	1.090
15	-	20	105	20	75	45	32	2	4	6	45	2	4	M12	14	1.190
15	21.3	-	105	20	75	45	34	2	4	6	45	2	4	M12	14	1.190
25	-	30	140	24	100	58	48	2.9	4	8	68	2	4	M16	18	2.660
25	33.7	-	140	24	100	58	52	2.9	4	8	68	2	4	M16	18	2.660
40	-	44.5	170	28	125	64	65	3.6	6	10	88	3	4	M20	22	4.300
40	48.3	-	170	28	125	64	70	3.6	6	10	88	3	4	M20	22	4.300
50	-	57	195	30	145	75	86	4	6	10	102	3	4	M24	26	6.250
50	60.3	-	195	30	145	75	90	4	6	10	102	3	4	M24	26	6.250
65	76.1	-	220	34	170	82	108	5	6	12	122	3	8	M24	26	8.350
80	88.9	-	230	36	180	86	120	6.3	8	12	138	3	8	M24	26	9.750
100	-	108	265	40	210	100	145	8	8	12	162	3	8	M27	30	14.80
100	114.3	-	265	40	210	100	150	8	8	12	162	3	8	M27	30	14.80
125	-	133	315	44	250	115	180	10	8	14	188	3	8	M30	33	23.00
125	139.7	-	315	44	250	115	180	10	8	14	188	3	8	M30	33	23.00
150	-	159	355	50	290	128	210	12.5	10	14	218	3	12	M30	33	32.50
150	168.3	-	355	50	290	128	210	12.5	10	14	218	3	12	M30	33	32.50
175	193.7	-	390	54	320	138	245	14.2	10	16	260	3	12	M33	36	43.50
200	219.1	-	430	60	360	140	278	16	10	16	285	3	12	M33	36	59.40
250	-	267	515	68	430	155	340	20	12	18	345	3	12	M39	42	94.50
250	273	-	515	68	430	155	340	20	12	18	345	3	12	M39	42	94.50
300	323.9	-	585	78	500	175	400	22.2	12	18	410	4	16	M39	42	136.0

The values in Part 2 are applicable for German standards.



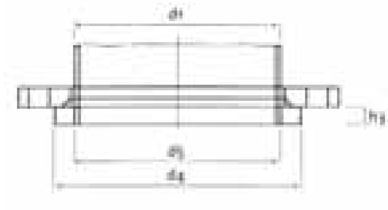
Nominal Bore			Flange					Stud Bolt			Weight of
NB	d1							pc.	thread	d_2	a Flange
	Part 1	Part 2	d_5	D	b	e	k				(7,85 kg/dm3)
10	-	14	14.5	75	12	5	50	4	M10	11	0.363
	17.2	-	17.7								
15	-	20	21	80	12	5	55	4	M10	11	0.410
	21.3	-	22								
20	-	25	26	90	14	5	65	4	M10	11	0.600
	26.9	-	27.6								
25	-	30	31	100	14	5	75	4	M10	11	0.740
	33.7	-	34.4								
32	-	38	39	120	16	5	90	4	M12	14	1.190
	42.4	-	43.1								
40	-	44.5	45.5	130	16	5	100	4	M12	14	1.390
	48.3	-	49								
50	-	57	58.1	140	16	6	110	4	M12	14	1.530
	60.3	-	61.1								
65	76.1	-	77.1	160	16	6	130	4	M12	14	1.890
80	88.9	-	90.3	190	18	7	150	4	M16	18	2.980
100	-	108	109.6	210	18	7	170	4	M16	18	3.460
	114.3		115.9								
125	-	133	134.8	240	20	7	200	8	M16	18	4.600
	139.7	-	141.6								
150	-	159	161.1	265	20	7	225	8	M16	18	5.220
	168.3	-	170.5								
200	219.1	-	221.8	320	22	7	280	8	M16	18	7.150
250	-	267	270.2	375	24	7	335	12	M16	18	9.610
	273	-	276.2								
300	323.9	-	327.6	440	24	7	395	12	M20	22	12.60
350	355.6	-	359.7	490	26	7	445	12	M20	22	15.60
	-	369	372.2								
400	406.4	-	411	540	28	7	495	16	M20	22	18.40
	-	419	423.7								
450	457	-	462.3	595	30	7	550	16	M20	22	21.40
500	508	-	513.6	645	30	7	600	20	M20	22	24.60



Nominal Bore			Flange					Stud Bolt			Weight of
NB	d1 Part 1	Part 2	d_5	D	b	e	k	pc.	thread	d_2	a Flange (7,85 kg/dm3)
10	-	14	14.5	90	14	5	60	4	M12	14	0.613
	17.2	-	17.7	0.605							
15	-	20	21	95	14	5	65	4	M12	14	0.675
	21.3	-	22	0.669							
20	-	25	26	105	16	5	75	4	M12	14	0.749
	26.9	-	27.6	0.936							
25	-	30	31	115	16	5	85	4	M12	14	1.140
	33.7	-	34.4	1.110							
32	-	38	39	140	16	5	100	4	M16	18	1.660
	42.4	-	43.1	1.620							
40	-	44.5	45.5	150	16	5	110	4	M16	18	1.890
	48.3	-	49	1.860							
50	-	57.0	58.1	165	18	6	125	4	M16	18	2.510
	60.3	-	61.1	2.470							
65	76.1	-	77.1	185	18	6	145	4	M16	18	3.000
80	88.9	-	90.3	200	20	7	160	8	M16	18	3.790
100	-	108	109.6	220	20	7	180	8	M16	18	4.200
	114.3	-	115.9	4.030							
125	-	133	134.8	250	22	7	210	8	M16	18	5.710
	139.70	-	141.6	5.460							
150	-	159	161.1	285	22	7	240	8	M20	22	6.720
	168.30	-	170.5	6.570							
175	193.7	-	196.1	315	24	7	270	8	M20	22	8.450
200	219.1	-	221.8	340	24	7	295	8	M20	22	9.310
250	-	267	270.2	395	26	7	350	12	M20	22	12.50
	273	-	276.2	11.90							
300	323.9	-	327.6	445	26	7	400	12	M20	22	13.80
350	355.6	-	359.7	505	28	7	460	16	M20	22	20.60
	-	368	372.2	19.00							
400	406.4	-	411	565	32	7	515	16	M24	26	27.90
	-	419	423.7	25.90							
450	457.4	-	462.3	615	38	7	565	20	M24	26	35.60
500	508	-	513.6	670	38	7	620	20	M24	26	41.10

Loose Flanges; Weld Neck Flanges, Plain Bundle

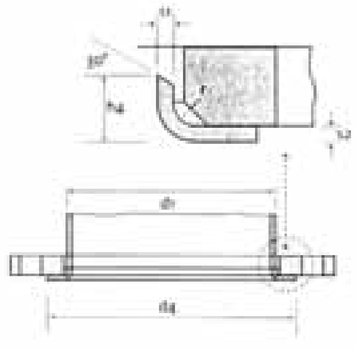
DIN 2641 PN 06



Plain Bundle



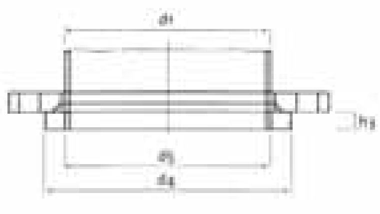
Loose Flange



Weld Neck Flange

Pipe Size NB	d1 Series 1	Series 2	Flange D	d6	b	k	e	Screws No.	Thread	d2	Bundle and Flange* d5	h3	d4	h4 max	s1 min	s2 min	r min	Weight kg (7,85 kg/dm³) Flange	Bundle
10	-	14	75	16	10	50	2	4	M10	11	14.5	8	35	9	1.8	3	2	0.298	0.0
10	17.2	-	75	19	10	50	2	4	M10	11	17.7	8	35	9	1.8	3	2	0.298	0.051
15	-	20	80	22	10	55	2	4	M10	11	21	8	40	9	2	3	2	0.337	0.063
15	21.3	-	80	24	10	55	2	4	M10	11	22	8	40	9	2	3	2	0.337	0.063
20	-	25	90	28	10	65	2	4	M10	11	26	10	50	12	2	3	2	0.418	0.116
20	26.9	-	-	30	10	65	2	4	M10	11	27.6	10	50	12	2	3	2	0.418	0.116
25	-	30	100	33	12	75	3	4	M10	11	31	10	60	15	2	3	3	0.620	0.166
25	33.7	-	-	36	12	75	3	4	M10	11	34.4	10	60	15	2	3	3	0.620	0.166
32	-	38	120	42	12	90	3	4	M12	14	39	10	70	15	2.6	3.5	3	0.874	0.213
32	42.4	-	-	46	12	90	3	4	M12	14	43.1	10	70	15	2.6	3.5	3	0.874	0.213
40	-	44.5	130	50	12	100	3	4	M12	14	45.5	10	80	17	2.6	3.5	3	1.01	0.273
40	48.3	-	-	54	12	100	3	4	M12	14	49	10	80	17	2.6	3.5	3	1.01	0.273
50	-	57	140	62	12	110	3	4	M12	14	58.1	12	90	23	2.6	3.5	3	1.12	0.359
50	60.3	-	-	65	12	110	3	4	M12	14	61.1	12	90	23	2.6	3.5	3	1.12	0.359
65	76.1	-	160	81	12	130	3	4	M12	14	77.1	12	110	23	2.6	3.5	3	1.35	0.468
80	88.9	-	190	94	14	150	3	4	M16	18	90.3	14	128	23	3.2	4	3	2.24	0.730
100	-	108	210	113	14	170	3	4	M16	18	109.6	14	148	28	3.2	4	3	2.59	0.884
100	114.3	-	-	119	14	170	3	4	M16	18	115.9	14	148	28	3.2	4	3	2.59	0.884
125	-	133	240	138	14	200	3	8	M16	18	134.8	14	178	30	3.2	4	3	3.10	1.21
125	139.7	-	-	145	14	200	3	8	M16	18	141.6	14	178	30	3.2	4	3	3.10	1.21
150	-	159	265	164	14	225	3	8	M16	18	161.1	14	202	30	3.2	4	3	3.52	1.34
150	168.3	-	-	173	14	225	3	8	M16	18	170.5	14	202	30	3.2	4	3	3.52	1.34
200	219.1	-	320	225	16	280	3	8	M16	18	221.8	16	258	30	3.2	4	3	4.98	2.00
250	-	267	375	273	20	335	3	12	M16	18	270.2	18	312	30	4	5	3	7.67	2.89
250	273	-	-	279	20	335	3	12	M16	18	276.2	18	312	30	4	5	3	7.67	2.89
300	323.9	-	440	329	24	395	4	12	M20	22	327.6	18	336	35	4	5	4	12.3	3.56
350	355.6	-	490	362	26	445	4	12	M20	22	359.7	18	415	-	-	-	4	15.1	4.08
350	-	368	-	374	26	445	4	12	M20	22	372.2	18	415	-	-	-	4	15.1	4.08
400	406.4	-	540	413	28	495	4	16	M20	22	411	20	465	-	-	-	4	17.7	4.91
400	-	419	-	426	28	495	4	16	M20	22	423.7	20	465	-	-	-	4	17.7	4.91
500	508	-	645	517	32	600	4	20	M20	22	513.6	22	570	-	-	-	4	25.4	7.39
600	610	-	755	618	36	705	4	20	M24	26	616.6	22	670	-	-	-	4	36.3	8.6
700	711	-	860	721	40	810	4	24	M24	26	718.6	24	775	-	-	-	4	48.1	14.0
800	813	-	975	824	44	920	4	24	M27	30	821.5	24	880	-	-	-	4	66.5	16.8
900	914	-	1075	926	48	1020	4	24	M27	30	923.5	26	980	-	-	-	4	81.3	20.1
1000	1016	-	1175	1028	52	1120	4	28	M27	30	1026.7	26	1080	-	-	-	4	96.4	21.5
1200	1220	-	1405	1232	60	1340	5	32	M30	33	1232.7	28	1295	-	-	-	5	158	32.6

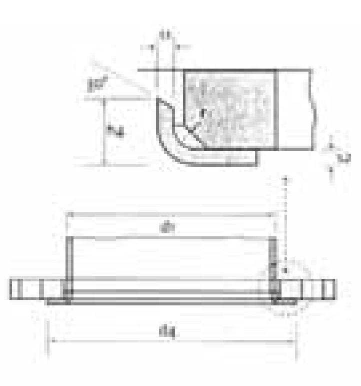
*) Flange from Nominal Bore 350 not standardized.
The pipe sizes of series 1 are international,
those of series 2 are still used in Germany.



Plain Bundle



Loose Flange



Weld Neck Flange

Pipe Size NB	d1 Series 1	Series 2	Flange D	d6	b	k	e	Screws No.	Thread	d2	Bundle and Flange* d5	h3	d4	h4 max	s1 min	s2 min	r min	Weight kg (7,85 kg/dm³) Flange	Bundle
10	-	14	90	16	14	60	3	4	M12	14	14.5	10	40	9	1.8	3	3	0.599	0.087
10	17.2	-	90	19	14	60	3	4	M12	14	17.7	10	40	9	1.8	3	3	0.599	0.087
15	-	20	95	22	14	65	3	4	M12	14	21	10	45	9	2	3	3	0.689	0.105
15	21.3	-	95	24	14	65	3	4	M12	14	22	10	45	9	2	3	3	0.689	0.105
20	-	25	105	28	14	75	3	4	M12	14	26	12	58	12	2	3	3	0.806	0.203
20	26.9	-	105	30	14	75	3	4	M12	14	27.6	12	58	12	2	3	3	0.806	0.203
25	-	30	115	33	16	85	4	4	M12	14	31	12	68	15	2	3	4	1.11	0.276
25	33.7	-	115	36	16	85	4	4	M12	14	34.4	12	68	15	2	3	4	1.11	0.276
32	-	38	140	42	16	100	4	4	M16	18	39	12	78	15	2.6	3.5	4	1.64	0.343
32	42.4	-	140	46	16	100	4	4	M16	18	43.1	12	78	15	2.6	3.5	4	1.64	0.343
40	-	44.5	150	50	16	110	4	4	M16	18	45.5	12	88	17	2.6	3.5	4	1.86	0.426
40	48.3	-	150	54	16	110	4	4	M16	18	49	12	88	17	2.6	3.5	4	1.86	0.426
50	-	57	165	62	16	125	5	4	M16	18	58.1	14	102	23	2.6	3.5	5	2.20	0.618
50	60.3	-	165	65	16	125	5	4	M16	18	61.1	14	102	23	2.6	3.5	5	2.20	0.618
65	76.1	-	185	81	16	145	5	4	M16	18	77.1	14	122	23	2.6	3.5	5	2.62	0.786
80	88.9	-	200	94	18	160	5	8	M16	18	90.3	16	138	23	3.2	4	5	3.32	1.10
100	-	108	220	113	18	180	5	8	M16	18	109.6	16	158	28	3.2	4	5	3.67	1.31
100	114.3	-	220	119	18	180	5	8	M16	18	115.9	16	158	28	3.2	4	5	3.67	1.31
125	-	133	250	138	18	210	5	8	M16	18	134.8	18	188	30	3.2	4	5	4.54	1.96
125	139.7	-	250	145	18	210	5	8	M16	18	141.6	18	188	30	3.2	4	5	4.54	1.96
150	-	159	285	164	18	240	5	8	M20	22	161.1	18	212	30	3.2	4	5	5.60	2.18
150	168.3	-	285	173	18	240	5	8	M20	22	170.5	18	212	30	3.2	4	5	5.60	2.18
200	219.1	-	340	225	20	295	5	8	M20	22	221.8	20	268	30	3.2	4	5	7.46	3.10
250	-	267	395	273	22	350	5	12	M20	22	270.2	22	320	30	4	5	5	10.3	4.22
250	273	-	395	279	22	350	5	12	M20	22	276.2	22	320	30	4	5	5	10.3	4.22
300	323.9	-	445	329	26	400	5	12	M20	22	327.6	22	370	35	4	5	5	14.0	4.85
350	355.6	-	505	362	28	460	6	16	M20	22	359.7	22	430	-	-	-	6	18.5	6.71
350	-	368	505	374	28	460	6	16	M20	-	372.2	22	430	-	-	-	6	18.5	6.71
400	406.4	-	565	413	32	515	6	16	M24	26	411	24	482	-	-	-	6	25.0	8.28
400	-	419	565	426	32	515	6	16	M24	-	423.7	24	482	-	-	-	6	25.0	8.28
500	508	-	670	517	38	620	6	20	M24	26	513.6	26	585	-	-	-	6	37.0	11.5
600	610	-	780	618	44	725	7	20	M27	30	616.6	26	685	-	-	-	7	56.3	15.6
700	711	-	895	721	50	840	7	24	M27	30	718.6	28	800	-	-	-	7	80.4	23.2
800	813	-	1015	824	56	950	7	24	M30	33	821.5	30	905	-	-	-	7	113.2	29.2

*) Flange from Nominal Bore 350 not standardized.
The pipe sizes of series 1 are international,
those of series 2 are still used in Germany.

Blind Flanges
DIN 2527 PN 06



Form B



Form T

Nominal Bore	Flange				Screws			Weight per Flange (7,85 kg/dm_) for	
	D	b	k	d_9 max.	No.	Thread	d_2	Form B kg	Form T kg
10	75	12	50		4	M10	11	0.38	
15	80	12	55					0.44	
20	90	14	65					0.65	
25	100	14	75					0.82	
32	120	14	90			M12	14	1.17	
40	130	14	100					1.39	
50	140	14	110					1.62	
65	160	14	130	55				2.44	2.48
80	190	16	150	70		M16	18	3.43	3.49
100	210	16	170	90				4.76	4.86
125	240	18	200	115	8			6.11	6.28
150	265	18	225	140				7.51	7.75
(175)	295	20	255	165				10.4	10.7
200	320	20	280	190				12.3	12.7
250	375	22	335	235	12			18.3	19.0
300	440	22	395	285		M20	22	25.3	26.3
350	490	22	445	330				31.6	32.9
400	540	22	495	380	16			38.4	40.2
500	645	24	600	475	20			60.4	63.2

Blind Flanges
DIN 2527 PN 10

Nominal Bore	Flange				Screws			Weight per Flange (7,85 kg/dm_) for	
	D	b	k	d_9 max.	No.	Thread	d_2	Form B kg	Form T kg
10 up to 175: For Nominal Bore 10 up to 175 Blind Flanges of Nominal Bore 16 are to be used.									
200	340	24	295	190	8	M20	22	16.5	16.9
250	395	26	350	235	12			24.0	24.7
300	445	26	400	285				30.9	31.9
350	505	26	460	330	16			40.6	41.9
400	565	26	515	380		M24	26	49.4	51.2
500	670	28	620	475	20			75.0	77.8

Blind Flanges
DIN 2527 PN 16



Form B



Form T

Nominal Bore	Flange				Screws			Weight per Flange (7,85 kg/dm_) for	
	D	b	k	d_9 max.	No.	Thread	d_2	Form B kg	Form T kg
10	90	14	60		4	M12	14	0.63	
15	95	14	65					0.72	
20	105	16	75					1.01	
25	115	16	85					1.23	
32	140	16	100			M16	18	1.80	
40	150	16	110					2.09	
50	165	18	125					2.88	
65	185	18	145	55				3.66	3.70
80	200	20	160	70	8			4.77	4.83
100	220	20	180	90				5.65	5.75
125	250	22	210	115				8.42	8.59
150	285	22	240	140		M20	22	10.4	10.6
(175)	315	24	270	165				14.0	14.3
200	340	24	295	190	12			16.1	16.5
250	405	26	355	235		M24	26	24.9	25.6
300	460	28	410	285				35.1	36.1
350	520	30	470	330	16			47.8	49.1
400	580	32	525	380		M27	30	63.5	65.3
500	715	36	650	475	20	M30	33	102	105

Blind Flanges
DIN 2527 PN 25

Nominal Bore	Flange				Screws			Weight per Flange (7,85 kg/dm_) for	
	D	b	k	d_9 max.	No.	Thread	d_2	Form B kg	Form T kg
10 up to 175	For Nominal Bore 10 up to 175 Blind Flanges of Nominal Pressure 16 are to be used.								
(175)	330	28	280	165	12	M24	26	17.3	17.6
200	360	30	310	190				22.3	22.7
250	425	32	370	237		M27	30	33.5	34.2
300	485	34	430	285	16			46.3	47.3
350	555	38	490	332		M30	33	68.0	69.3
400	620	40	550	380		M33	36	89.7	91.5
500	730	45	660	475	20			138	141

Blind Flanges
DIN 2527 PN 40



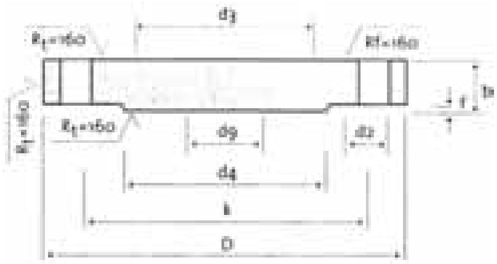
Form B



Form T

Nominal Bore	Flange				Screws			Weight per Flange (7,85 kg/dm_) for	
	D	b	k	d_9 max.	No.	Thread	d_2	Form B kg	Form T kg
10	90	16	60		4	M12	14	0.72	
15	95	16	65					0.81	
20	105	18	75					1.24	
25	115	18	85					1.38	
32	140	18	100			M16	18	2.03	
40	150	18	110					2.35	
50	165	20	125					3.20	
65	185	22	145	55	8			4.29	4.33
80	200	24	160	70				5.88	5.94
100	235	24	190	90		M20	22	7.54	7.64
125	270	26	220	115		M24	26	10.8	11.0
150	300	28	250	140				14.5	14.7
(175)	350	32	295	165	12	M27	30	22.1	22.4
200	375	34	320	190				27.2	27.6
250	450	38	385	235		M30	33	43.8	44.5
300	515	42	450	285	16			63.3	64.3
350	580	46	510	330		M33	36	89.5	90.8
400	660	50	585	380		M36	39	127	129
500	755	56	670	475	20	M39	42	172	175

Blind Flanges
DIN 2527 PN 64

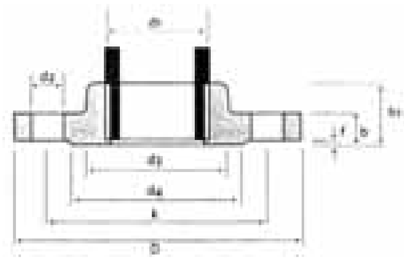


Nominal Bore	Flange							Screws			Weight per Flange (7,85 kg/dm_) for
	D	b	k	d_3	d_4	d_9	f	No.	Thread	d2	
10 up to 40	For Nominal Bore 10 up to 40 Blind Flanges of Nominal Pressure 100 are to be used.										
50	180	26	135	82	102	-	3	4	M20	22	4.51
65	205	26	160	98	122	45	3	8	M20	22	5.71
80	215	238	170	112	138	60	3	8	M20	22	6.92
100	250	30	200	138	162	80	3	8	M24	26	10.1
125	295	34	240	168	188	105	3	8	M27	30	16.0
150	345	36	280	202	218	130	3	8	M30	33	23.5
(175)	375	40	310	228	260	155	3	12	M30	33	30.8
200	415	42	345	256	285	180	3	12	M33	36	39.7
250	470	46	400	316	345	220	3	12	M33	36	57.4
300	530	52	460	372	410	270	4	16	M33	36	81.0
350	600	56	525	420	465	310	4	16	M36	39	114
400	670	60	585	475	535	360	4	16	M39	42	153

Blind Flanges
DIN 2527 PN 100

Nominal Bore	Flange							Screws			Weight per Flange (7,85 kg/dm_) for
	D	b	k	d_3	d_4	d_9	f	No.	Thread	d2	
10	100	20	70	32	40	-	2	4	M12	14	1.00
15	105	20	75	34	45	-	2	4	M12	14	1.22
25	140	24	100	52	68	-	2	4	M16	18	2.65
32	155	24	110	62	78	-	2	4	M20	22	3.24
40	170	26	125	70	88	-	3	4	M20	22	4.09
50	195	28	145	90	102	-	3	4	M24	26	5.84
65	220	30	170	108	122	45	3	8	M24	26	8.03
80	230	32	180	120	138	60	3	8	M24	26	9.43
100	265	36	210	150	162	80	3	8	M27	30	14.3
125	315	40	250	180	188	105	3	8	M30	33	22.6
150	355	44	290	210	218	130	3	12	M30	33	31.8
(175)	385	48	320	245	260	155	3	12	M30	33	41.3
200	430	52	360	278	285	180	3	12	M33	36	56.1
250	505	60	430	340	345	210	3	12	M36	39	89.6
300	585	68	500	400	410	260	4	16	M39	42	119
350	655	74	560	460	465	300	4	16	M45	48	175

Threaded Flange
DIN 2565 PN 06



NB	d1	Flange Whitworth Pipe Thread DIN 2999	D	b	k	ht	Neck d_3	Sealing Groove d_4	f	Screws No.	Thread	d_2	Weight per Flange (7,85 kg/dm_)kg
6	10	R1/8	65	10	40	18	18	25	2	4	-	11.5	0.190
8	13.25	R1/4	70	10	45	18	22	30	2	4	-	11.5	0.227
10	15.75	R3/8	75	12	50	20	25	35	2	4	-	11.5	0.323
15	21.25	R1/2	80	12	55	20	30	40	2	4	-	11.5	0.373
20	26.75	R3/4	90	14	65	24	40	50	2	4	-	11.5	0.590
25	33.5	R1	100	14	75	24	50	60	2	4	-	11.5	0.743
32	42.25	R1.1/4	120	14	90	26	60	70	2	4	-	15	1.05
40	48.25	R1.1/2	130	14	100	26	70	80	3	4	-	15	1.20
50	60	R2	140	14	110	28	80	90	3	4	-	15	1.37
(60)	(66)	R2.1/4	150	14	120	30	90	100	3	4	-	15	1.57
70	75.5	R2.1/2	160	14	130	32	100	110	3	4	-	15	1.92
80	88.25	R3	190	16	150	34	110	128	3	4	-	18	2.85
(90)	(101)	R3.1/2	200	16	160	36	120	138	3	4	-	18	3.04
100	113.5	R4	210	16	170	38	130	148	3	4*	-	18	3.19
125	139	R5	240	18	200	40	160	178	3	8	-	18	4.47
150	164.5	R6	265	18	225	44	185	202	3	8	-	18	5.80

*) For Pipelines 8 Srews are recommended.

Threaded Flange
DIN 2566 PN 10

NB	d1	Flange Whitworth Pipe Thread DIN 2999	D	b	k	ht	Neck d_3	Sealing Groove d_4	f	Screws No.	Thread	d_2	Weight per Flange (7,85 kg/dm_)kg
6	10.2	R1/8	75	12	50	18	20	32	2	4	M10	11	0.326
8	13.5	R1/4	80	12	55	18	25	38	2	4	M10	11	0.380
10	17.2	R3/8	90	14	60	20	30	40	2	4	M12	14	0.544
15	21.3	R1/2	95	14	65	20	35	45	2	4	M12	14	0.613
20	26.9	R3/4	105	16	75	24	45	58	2	4	M12	14	0.910
25	33.7	R1	115	16	85	24	52	68	2	4	M12	14	1.10
32	42.4	R1.1/4	140	16	100	26	60	78	2	4	M16	18	1.60
40	48.3	R1.1/2	150	16	110	26	70	88	3	4	M16	18	1.78
50	60.3	R2	165	18	125	28	85	102	3	4	M16	18	2.43
65	76.1	R2.1/2	185	18	145	32	105	122	3	4	M16	18	3.18
80	88.9	R3	200	20	160	34	118	138	3	8	M16	18	4.12
100	114.3	R4	220	20	180	38	140	158	3	8	M16	18	4.47

Flat Face Flange



Form A
Simple Face

Form B
Face RZ = 160, machined (not finer than 40µm)

Face Flange



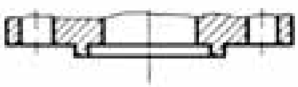
Form C
Face R_Z = 160 (not finer than 40µm), machined

Form D
Face RZ = 40, machined

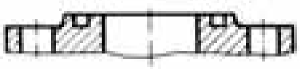
Form E
Face RZ = 16, machined

Flange with Integrated Sealing

Form F
Tongue as per DIN 2512



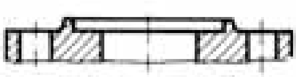
Form N
Groove as per DIN 2512



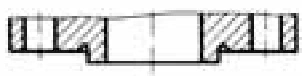
Form V 13
Projection as per DIN 2513



Form R 13
Recess as per DIN 2513



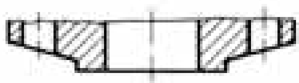
Form V 14
Projection as per DIN 2514



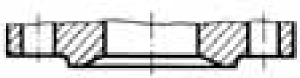
Form R 14
Recess as per DIN 2514



Form M
Bevel for Diaphram Seal as per DIN 2695



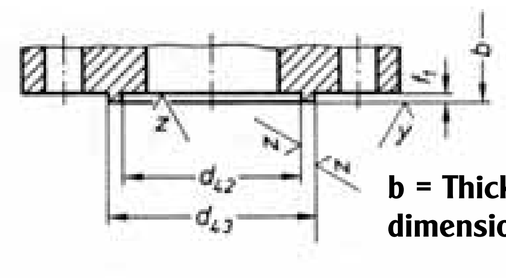
Form L
Lens Ring Face



Flanges, groove and tongue, nominal pressures 10 to 160 design sizes, rings

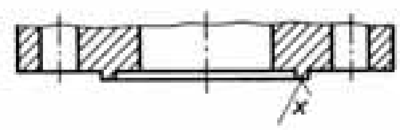
Dimensions in mm

Tongue
Form F (normal case)

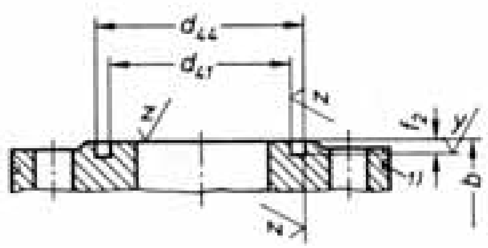


b = Thickness as per dimension standard

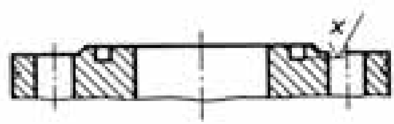
Form FA (special case)
Other dimensions and indications as Form F



Groove
Form N (normal case)



Form V 14
Form NA (special case)
Other dimensions and indications as Form N



$z\sqrt{} = \sqrt{R_z = 160}$

rotated

$z\sqrt{} = \sqrt{R_z = 160}$

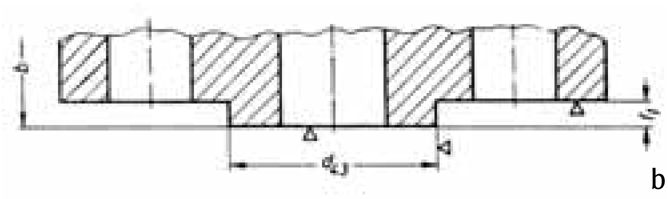
rotated

$z\sqrt{} = \sqrt{R_z = 160}$

Flanges
Projection and Recess
Nominal Pressures 10 to 100

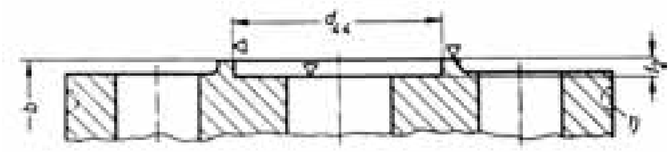
Dimensions in mm

Projection Flange
Form V 13



b = Plate thickness as per standard

Recess Flange
Form R 13



Nominal Bore	Projection d_{43} -0.5	Projection f_1 +0.5	Recess d_{44} +0.5	Recess f_2 -0.5
10	34	4	35	3
15	39	4	40	3
20	50	4	51	3
25	57	4	58	3
32	65	4	66	3
40	75	4	76	3
50	87	4	88	3
65	109	4	110	3
80	120	4	121	3
100	149	4.5	150	3.5
125	175	4.5	176	3.5
150	203	4.5	204	3.5
(175)	233	4.5	234	3.5
200	259	4.5	260	3.5
250	312	4.5	313	3.5
300	363	4.5	364	3.5
350	421	5	422	4
400	473	5	474	4
500	575	5	576	4
600	675	5	676	4
700	777	5	778	4
800	882	5	883	4
900	987	5	988	4
1000	1091	6	1092	5

Nominal bore in brackets to be avoided if possible.

1) Recess Flanges can be marked with groove at outside if required

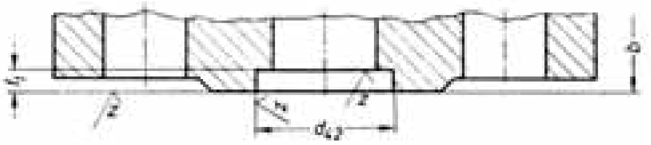
Flanges, Table see DIN 2500
Flanges, Types of contact faces see DIN 2526
Steel Flanges, technical delivery conditions see DIN 2519
Flat Ring Gasket for Flanges with projection and recess see DIN 2692

Flanges groove for rubber seal ring
Nominal Pressures 10 to 40 design sizes

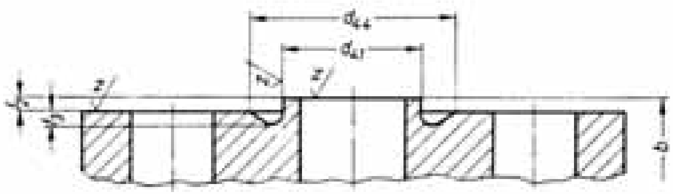
Dimensions in mm

This norm is valid in connection with the corresponding dimensional standards for flanges.
The lens ring face can be used also for plain flanges or flanges with sealing ring.

Recess
Form R



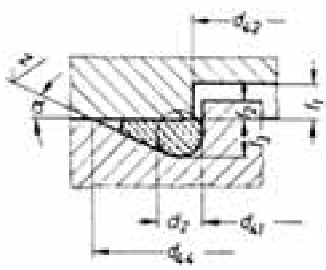
Projection
Form V



rotated

$$\sqrt[z]{} = \sqrt{R_z = 160}$$

Dimensions for assembly
b **= plate thickness as per standard**



TYPES OF VALVE

BOLTED BONNET VALVES

- GATE VALVE
- GLOBE VALVES
- SWING CHECK VALVES
- PISTON CHECK VALVES
- TILTING DISC CHECK VALVES
- Y PATTERN GLOBE VALVES

PRESSURE SEAL VALVES

- GATE VALVES
- GLOBE VALVES
- SWING CHECK VALVES
- PISTON CHECK VALVES
- TILTING DISC CHECK VALVES
- Y PATTERN GLOBE VALVES

API 6D VALVES

THROUGH CONDUIT GATE VALVES
FULL-OPENING SWING CHECK VALVES
REDUCED OPENING SWING CHECK VALVES

WAFER CHECK VALVES

CRYOGENIC SERVICE VALVES

SPECIAL SERVICES VALVES

- 3-WAYS GLOBE VALVES
- SLUICE GATE VALVES
- JACKETED VALVES
- BELLOW SEAL VALVES
- CAST STAINLESS STEEL GATES VALVES ACC. API 603
- BLOCK & BLOOED GATES VALVES



GATE VALVES – Standard – Cryogenic – Bellow Seals

Cast Steel	Type	Bolted Bonnet, OS&Y					
	Class	150	300	600	900	1500	2500
	Sizes	2"– 56"	2"– 48"	2"– 48"	2"– 24"	2"– 24"	2"–12"
	Ends	RF – RTJ – BW					
Forged Steel	Type	Bolted Bonnet, OS&Y					
	Class	150	300	600	1500	2500	
	Sizes	1/2"– 2"					
	Ends	RF – RTJ – BW					
	Type	Bolted Bonnet, OS&Y					
	Class	800	1500	2500			
	Sizes	1/4"– 2"					
	Ends	NPT – SW – BW					
	Type	Seal Weldet Bonnet, OS&Y					
	Class	300	600	1500	2500		
	Sizes	1/4"– 2"					
	Ends	NPT – SW – RF – RTJ – BW					



GLOBE VALVES – Straight Pattern, Standard – Cryogenic, Bellow Seal

Cast Steel	Type	Bolted Bonnet, OS&Y						
	Class	150	300	600	900	1500	2500	
	Sizes	2"– 16"	2"– 16"	2"– 12"	2"– 10"	2"– 8"	2"–8"	
	Ends	RF – RTJ – BW						
Forged Steel	Type	Bolted Bonnet, OS&Y						
	Class	150	300	600	1500	2500		
	Sizes	1/2"– 2"						
	Ends	RF – RTJ – BW						
	Type	Bolted Bonnet, OS&Y			Seal Welded Bonnet			
	Class	800	1500	2500	800	1500	2500	4500
	Sizes	1/4"– 2"			1/4"– 2"			
	Ends	NPT – SW – BW			NPT – SW – BW			



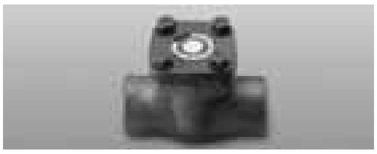
GLOBE VALVES – Y-Pattern, Standard & Bellow Seal

Forged Steel	Type	Seal Weldet Bonnet, OS&Y			
	Class	800	1500	2500	4500
	Sizes	1/4"– 4"			
	Ends	NPT – SW – BW – RF – RTJ			



SWING CHECK, PISTON CHECK, WAFER CHECK VALVES

Cast Steel	Type	Bolted Cover						
	Class	150	300	600	900	1500	2500	
	Sizes	2"– 48"	2"– 36"	2"– 36"	2"– 24"	2"– 24"	2"–12"	
	Ends	RF – RTJ – BW – WAFER						
Forged Steel	Type	Bolted Cover						
	Class	150	300	600	1500	2500		
	Sizes	1/2"– 2"						
	Ends	RE – RTJ – BW						
	Type	Bolted Cover			Seal Welded Cover			
	Class	800	1500	2500	800	1500	2500	4500
	Sizes	1/4"– 2"			1/4"– 2"			
	Ends	NPT – SW – BW			NPT – SW – BW			



PISTON CHECK, BALL CHECK & SWING CHECK VALVES

Forged Steel	Type	Straight-Bolted C			Y-Pattern, Seal Weld. Cover			
	Class	800	1500	2500	800	1500	2500	4500
	Sizes	1/4"– 2"			1/4"– 2"			
	Ends	NPT – SW – BW			NPT – SW – BW			



PRESSURE SEAL VALVES, CAST & FORGED STEEL

Gate	Class	600	900	1500	2500	4500
	Sizes	2"– 24"	2"– 24"	2"– 24"	2"– 14"	2"– 3"
	Ends	RF – RTJ – BW				
Globe & Stop Check	Class	600	900	1500	2500	4500
	Sizes	2"– 16"	2"– 16"	2"– 12"	2"– 12"	2"– 3"
	Ends	RF – RTJ – BW				
Swing Check & Tilting Disk Check	Class	600	900	1500	2500	
	Sizes	2"– 16"	2"– 16"	2"– 12"	2"– 12"	
	Ends	RF – RTJ – BW				
Piston Check	Class	600	900	1500	2500	4500
	Sizes	2"– 12"	2"– 12"	2"– 12"	2"– 12"	2"– 3"



THROUGH CONDUIT GATE VALVES, CAST STEEL

Slab Gate	Class	150	300	600	900	1500	2500
	Sizes	2"– 48"	2"– 48"	2"– 36"	2"– 24"	2"– 16"	2"–12"
	Ends	RF – RTJ – BW					
Expanding Gate	Class	150	300	600	900	1500	2500
	Sizes	2"– 36"	2"– 36"	2"– 36"	2"– 24"	2"– 16"	2"–12"
	Ends	RF – RTJ – BW					
Options	Gear Operator – Electric-Pneumatic, Hydraulic Actuators, Position Indicators – Stem Protection – Locking Devices, Soft Seals, Special Packings						



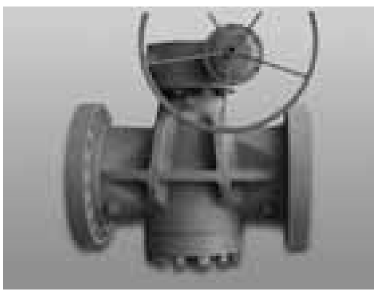
BALL VALVES – FULL BORE & REDUCED BORE, CAST & FORGED STEEL

Split Body, Bolted & Welded Construction	Class	150	300	600	900	1500	2500	API
	Sizes	1/2"– 60"			1/2"– 48"	1/2"– 42"	1/2"– 20"	1/2–30"
	Ends	RF – RTJ – BW						
1-Pce. Body Side Entry	Class	800			1500			
	Sizes	1/4"– 4"			1/4"– 4"			
	Ends	RF – RTJ – BW						
1-Pce. Body Top Entry	Class	150	300	600	900	1500	2500	API
	Sizes	1/2"– 60"			1/2"– 42"	1/2"– 40"	1/2"– 20"	1/2–30"
	Ends	RF – RTJ – BW						



BUTTERFLY VALVES – SOFT SEATED & METAL SEATED HIGH PERFORMANCE

Materials	Cast Iron, Carbon Steel, Stainless Steel, Aluminium, Bronze & Alloys
Classes	ANSI 150 & ANSI 300
Sizes	1 1/2"–32" Wafer Type, 1 1/2"–16" Lug, 2"–72" Flanged



PLUG VALVES

Lubricated 2-Way & 3-Way	Class	150	300	600	800/1500	900	1500	2500
	Sizes	1/2"–30"	1/2"– 24"	1/2"–24"	1/4"–2"	1–16"	2–16"	2–12"
	Ends	RF – RTJ – BW			NPT– SW-RTJ – BW			
Non Lubricated 2-Way & 3-Way	Class	150 & 300			150 & 300			
	Sizes	1/2"– 12"			1/2"– 2 1/2"			
	Ends	RF – BW			NPT SW			

OTHER VALVES Diaphragm Valves; Needle/Gauge Valves, Cocks, Plastic Valves, Air Release & Vacuum Valves, Line Blinds, Traps, Strainers, Orifice Fittings

VALVE TPYE	PRESSURE CLASS	END CONNECTION	BODY MATERIALS	TRIM MATERIALS	OPERATION
Gate	Class 150	Flat Face	A 216-WCB	13%Cr	Handwheel
Globe	Class 300	Raised Face	A 216-WCC	304	Impact Handwheel
Swing Check	Class 600	Large Male	A 217-WC1	316	Chain
Piston Check	Class 900	Small Male	A 217-WC6	304-L	Bevel Gear
Tilting Disc	Class 1500	Large Female	A 217-WC9	316-L	Spur Gear
Globe Y Pattern	Class 2500	Small Female	A 217-C5	321	Pneumatic
	Class 4500	Large Tongue	A 217-C12	347	Hydraulic
		Small Tongue	A 217-C12A	51	Electric
		Large Groove	A 352-LCB	55	
		Small Groove	A 352-LCC	Bronze	
		R.T.J.	A 352-LC2	Monel	
		Buttwelded Ends	A 352-LC3	Hastelloy B	
		Threaded End	A 351-CF8	Hastelloy C	
			A 351-CF8M	B-473	
			A 351-CF3	(Alloy 420)	
			A 351-CF3M	Half Stellite	
			A 351-CF8C	Stellite	
			A-351-CD4Mcu		
			A 890-5A		
			A 351-CN7M		
			Hastelloy B		
			Hastelloy C		



Pressure seal Gate valve



Gate valve



Swing Check valve



Globe valve

MANUFACTURING PROGRAM

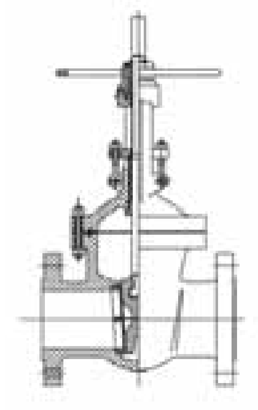
Sizes are in inches



Bolted Bonnet Gate Valve with Spur and Bevel actuator.
Class: 1500#. Size: 16″

GATE VALVES

ANSI Class	SIZE From	To
150	2″	72″
300	2″	54″
600	2″	54″
900	2″	36″
1500	2″	24″
2500	2″	20″

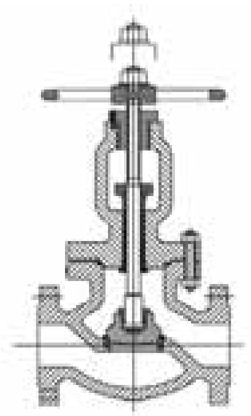


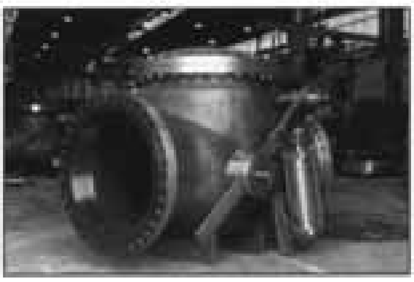


Bolted Bonnet Globe Valve with electric actuator.
Class: 1500#. Size: 16″

GLOBE VALVES

ANSI Class	SIZE From	To
150	2″	24″
300	2″	24″
600	2″	24″
900	2″	20″
1500	2″	18″
2500	2″	16″

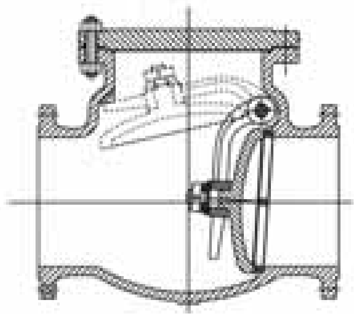




Swing Check Valve with damper.
Class: 150#. Size: 40″

SWING CHECK VALVES

ANSI Class	SIZE From	To
150	2″	64″
300	2″	54″
600	2″	54″
900	2″	36″
1500	2″	24″
2500	2″	20″



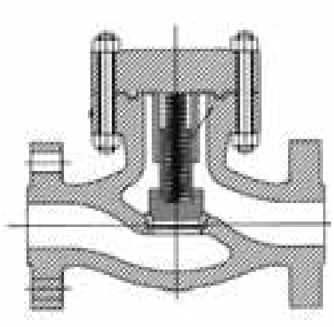
MANUFACTURING PROGRAM
Sizes are in inches

PISTON CHECK VALVES

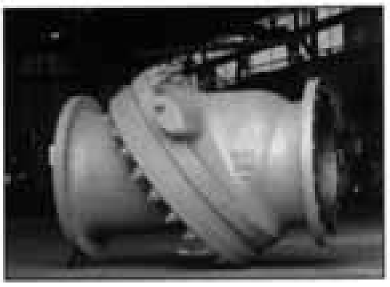


Piston Check Valve.
Class: 2500#. Size: 6″

ANSI Class	SIZE From	SIZE To
150	2″	10″
300	2″	10″
600	2″	10″
900	2″	10″
1500	2″	10″
2500	2″	10″

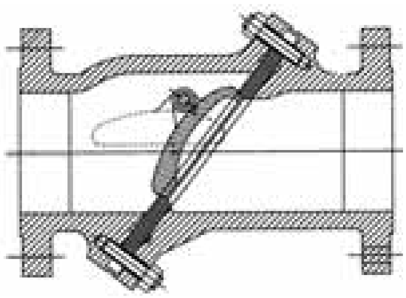


TILTING DISC CHECK VALVES



Tilting Disc Check Valve.
Class: 150#. Size: 18″

ANSI Class	SIZE From	SIZE To
150	2″	24″
300	2″	24″
600	2″	24″
900	2″	20″
1500	2″	18″
2500	2″	12″

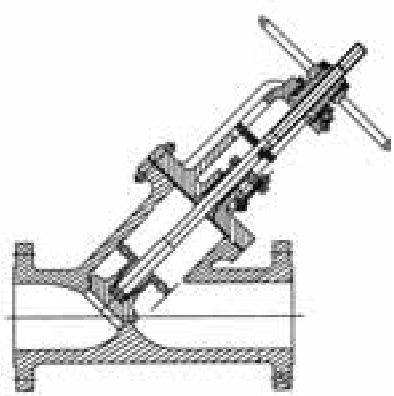


Y-PATTERN GLOBE VALVES



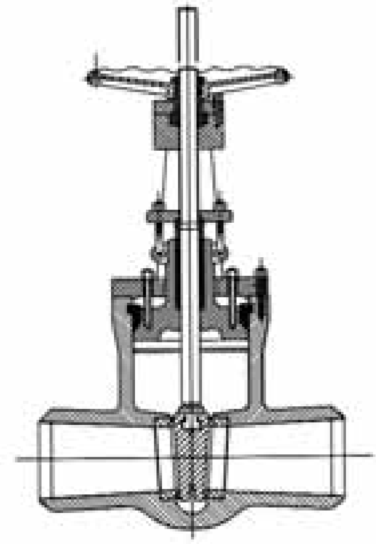
Y Pattern Globe Valve.
Class: 150#. Size: 5″

ANSI Class	SIZE From	SIZE To
150	2″	16″
300	2″	16″
600	2″	14″
900	2″	12″
1500	2″	12″
2500	2″	10″



MANUFACTURING PROGRAM

Sizes are in inches

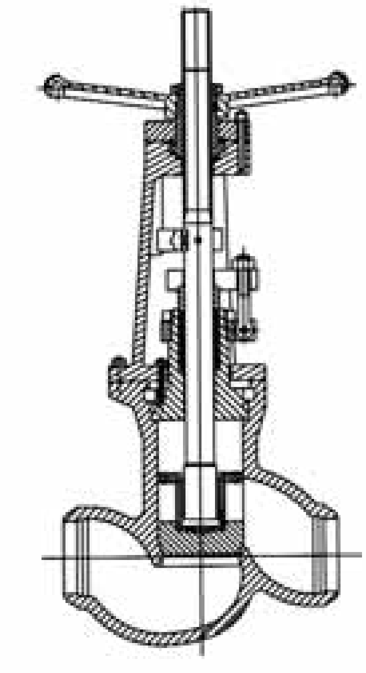


GATE VALVES

ANSI Class	SIZE From	To
600	2″	30″
900	2″	24″
1500	2″	24″
2500	2″	20″
4500	2″	8″



Pressure Seal Gate Valve.
Class: 600#. Size: 30″

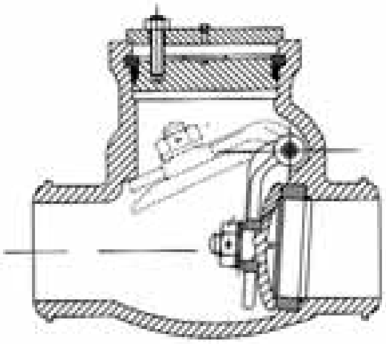


GLOBE VALVES

ANSI Class	SIZE From	To
600	2″	16″
900	2″	16″
1500	2″	16″
2500	2″	12″
4500	2″	6″

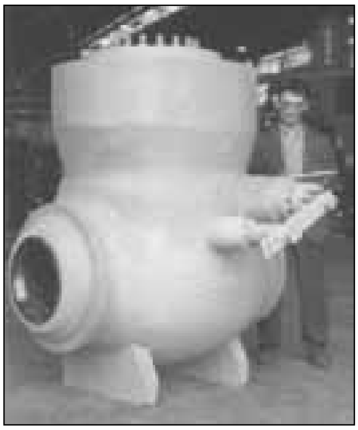


Pressure Seal Globe Valve.
Class: 600#. Size: 6″



SWING CHECK VALVES

ANSI Class	SIZE From	To
600	2″	30″
900	2″	24″
1500	2″	24″
2500	2″	20″
4500	2″	8″



Pressure Seal Swing Check Valve.
Class: 2500#. Size: 20″

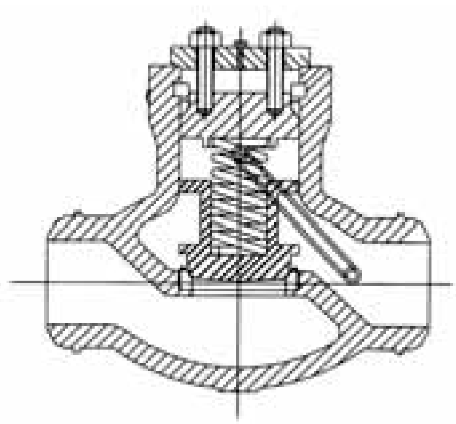
MANUFACTURING PROGRAM
Sizes are in inches

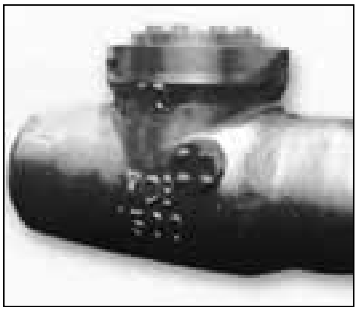


Pressure Seal Piston check Valve.
Class: 600#. Size: 6″

PISTON CHECK VALVES

ANSI Class	SIZE From	SIZE To
600	2″	16″
900	2″	16″
1500	2″	16″
2500	2″	12″
4500	2″	8″

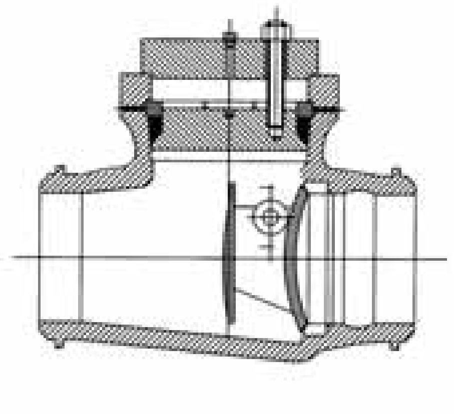




Pressure Seal Tilting disc check Valve.
Class: 1500#. Size: 10″.

TILTING DISC VALVES

ANSI Class	SIZE From	SIZE To
600	2″	30″
900	2″	24″
1500	2″	24″
2500	2″	16″
4500	2″	8

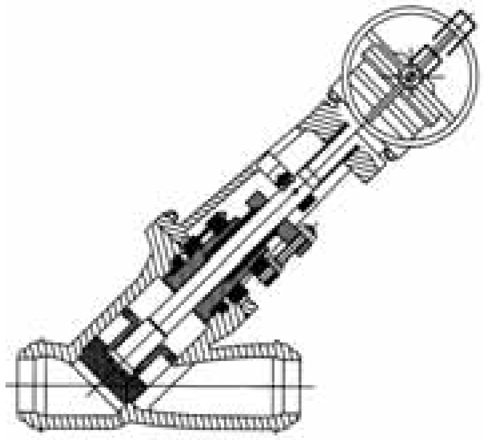




Y Pattern Globe Valve.
Class: 150#. Size: 6″

Y PATTERN GLOBE VALVES

ANSI Class	SIZE From	SIZE To
600	2″	14″
900	2″	12″
1500	2″	12″
2500	2″	10″

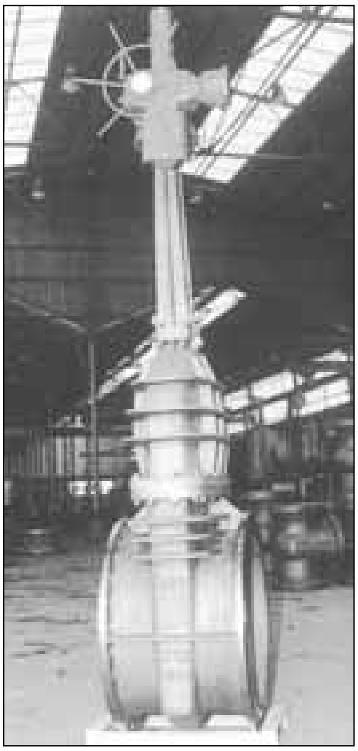


CAST STAINLESS STEEL GATE VALVES API 603

Grades of CF8M, CF8, CF3M, etc. are made to ANSI Class 150, with wall thicknesses to B 16.34.

Evntually we will be able to supply ANSI Class 300.

ANSI	SIZE	
Class	From	To
150	2″	48″



Gate Valve, size 40″, class 150, manufactured in stainless steel CF3M for Desalination Plant.

BLOCK & BLEED GATE VALVES

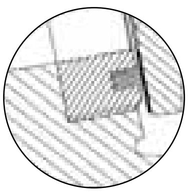
The Block and Bleed Gate Valves are used to prevent different types of fluids from mixing.

These valves provide a seal in both directions at pressures ranging from zero to maximum working pressure, regardless of fluctuations in pressure, pressure differentials or the direction of flow.

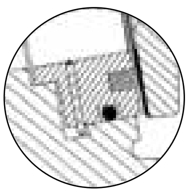
ANSI	SIZE	
Class	From	To
150	2″	48″
300	2″	36″



Block & Bleed gate valve. Class: 150#. Size: 28″.



Detail of seal with Teflon insert for bores Of 2″ to 12″.



Detail of seal with floating rings for bores Of 14″ and above.

for use in critical applications in the chemical, petrochemical, oil and gas, nuclear power, cryogenic industries, etc.

SPECIAL SERVICE VALVES:

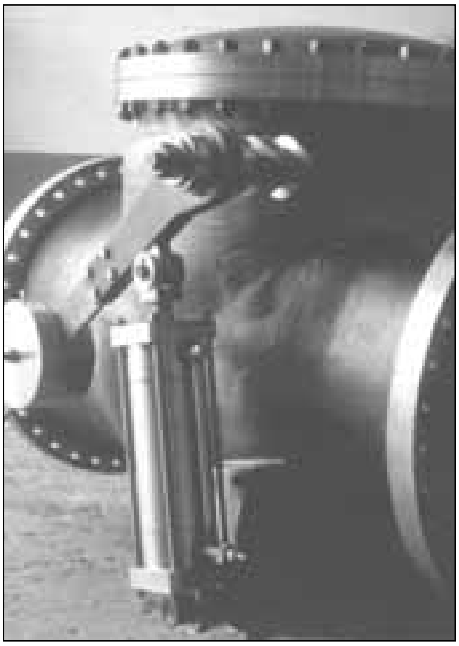
- JACKETED VALVES
- 3-WAY GLOBE VALVES
- BELLOW SEAL VALVES
- SLUICE GATE VALVES
- CRYOGENIC SERVICE VALVES
- WAFER TYPE GATE VALVES



Gate Valve Wafer type. Size 36"



*Bolted Bonnet Globe Valve with Bellow.
Class: 600 #. Size: 3".*



Swing check Valve with damper.



Jacketed Valves, Gate and swing check.



Gate Valves in stainless eqipped with electric actuator



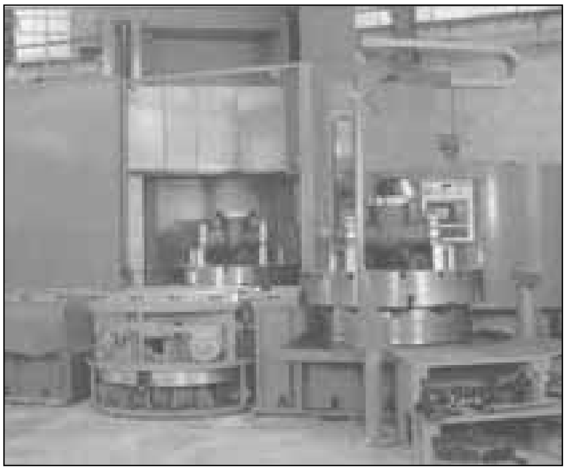
Bolted Bonnet Gate Valve. Class: 600 #. Size: 48".



Pressure Seal Gate valve. Class: 600 #. Size: 24"



Bolted Bonnet Gate Valve. Class: 900#. Size: 20".



CNC Machine Centre.



Pressure seal gate valve



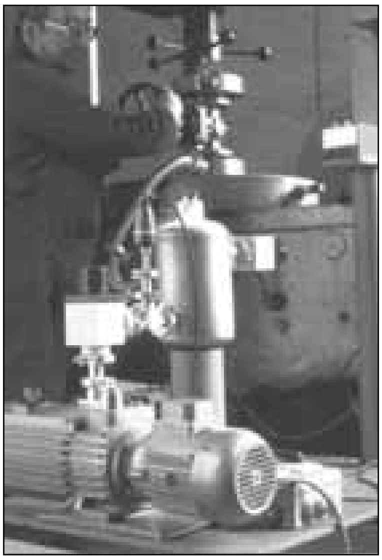
Stress checking test



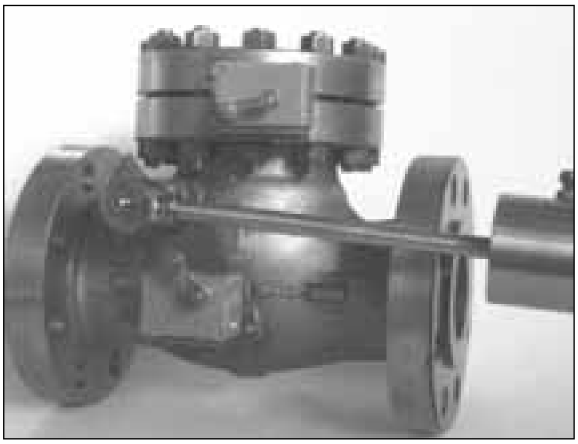
Dual plate wafer check valve. Class: 900#. Size: 36"



Dye penetrating inspection.



Vacuum test.



Bolted Bonnet swing check valve. Class: 1500#. Size: 4".



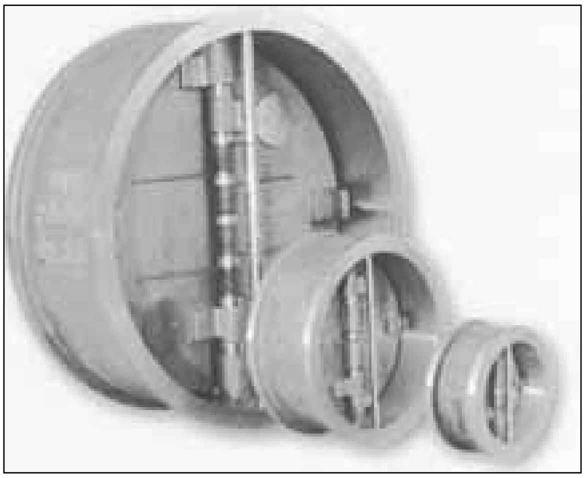
Globe Bellow Valves

DUAL PLATE WAFER CHECK VALVES

Is a check valve for general use, characterised by its reduced weight.

Due to the wide range of build materials (carbon, alloy or stainless steel, etc.) it can meet any service requirements.

The continuous spring force applied to the disc prevents any back-flow through the valve, providing a smooth, noise-free action.



Dual plate wafer check valves.

ANSI Class	SIZE From	To
125	2″	72″
150	2″	54″
300	2″	54″
600	2″	36″
900	2″	24″
1500	2″	20″
2500	2″	36″

CRYOGENIC SERVICE VALVES

Cryogenic valves, in gate, globe and check types for the production, storage and transfer of liquefied gases such as nitrogen, oxygen, natural gas, argon, hydrogen, methane, carbon dioxide, etc.

Lazaro Ituarte produce special extended bonnet stainless steel valves that offer excellent impact strength, minimal heat loss and protection against corrosion.



Cryogenic Gate Valve.
Class: 300#. Size: 16″ in stainless steel CF8

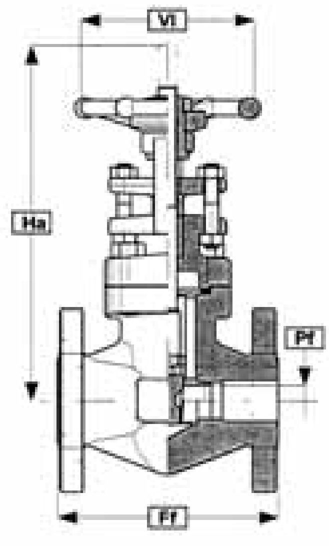
CRYOGENIC GATE VALVES

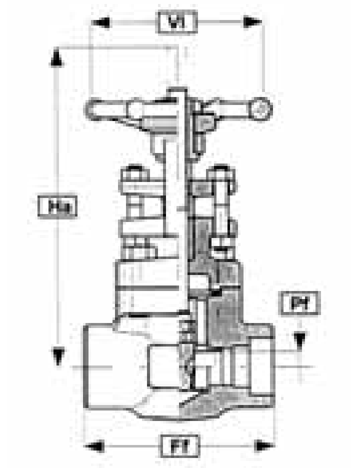
ANSI Class	SIZE From	To
150	2″	24″
300	2″	24″
600	2″	24″
900	2″	16″

CRYOGENIC GLOBE VALVES

ANSI Class	SIZE From	To
150	2″	12″
300	2″	12″
600	2″	8″
900	2″	8″

Production range





Type

Gate, Globe/Stop/Needle, Piston/Ball/Swing-check, Drop & Block check

(Urea Service)

Body joining

Bolted and Welded bonnet (seal or full penetration), Bonnetless and

Pressure seal

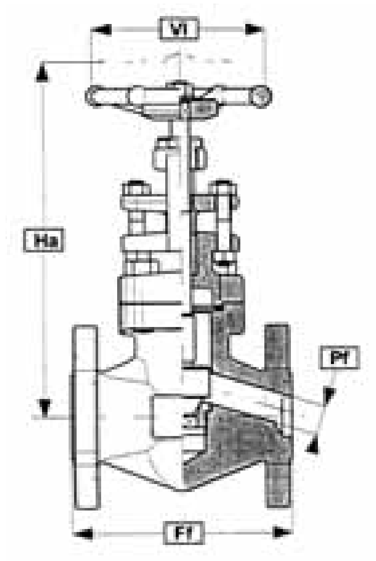
Execution

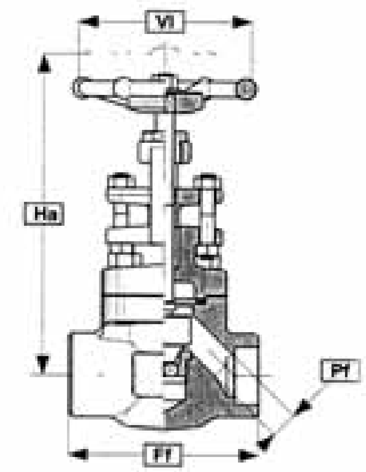
Straight, Y pattern & Angle, Bellows Seals, Cryogenic service, Vacuum

service, OS&Y, ISRS, ...

Motorized

with Electric, Pneumatic actuators, ...





Sizes

1/4″ to 2″ reduced and full bore (Urea service up to 8″)

End connections

SW, Threaded, BW, Hub and Flanged (integral type)

Rating

ANSI class 150 to 4500 lbs

Materials

Carbon steel

- ASTM A105

Killed Carbon steel

- ASTM A350 / LF2

Alloy steel

- ASTM A182 – F5, F9, F11, F22, F91

Stainless steel

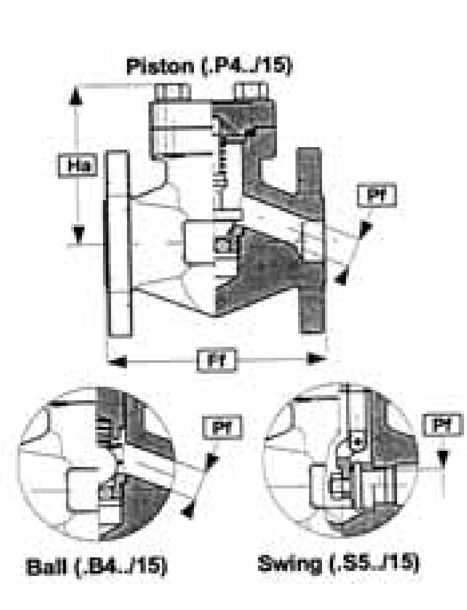
- ASTM A182/F304(L), F316(L), F317, F321, F347, F44

Special Alloy

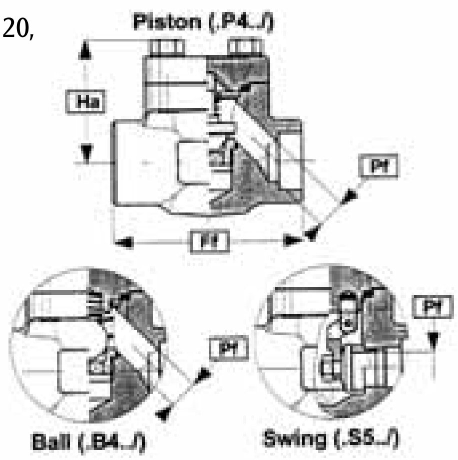
- Monel, Inconel, Incoloy, Hastelloy, UNS, Alloy 20, Sanicro 28, Titanium, ...

Duplex

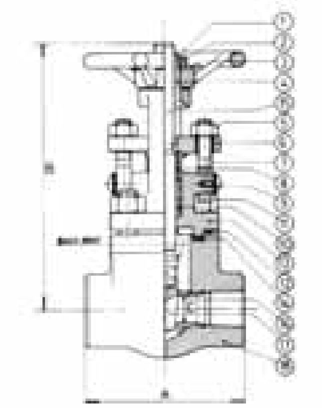
- ASTM A 182/F51, F53, F55



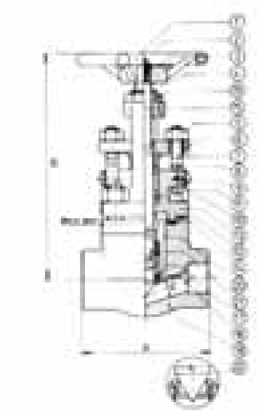
Material Test Report
NDE, Mechanical and Chemical Analysis
Hydro Test
Air Test
Performance Test
Cryogenic Test
Special tests available on request



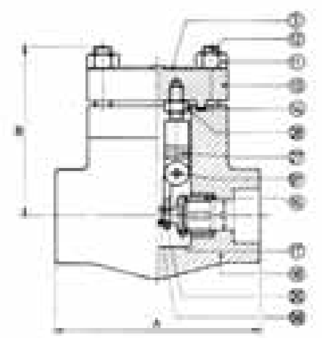
FORGED STEEL GATE, GLOBE, CHECK VALVES
CARBON, ALLOY, STAINLESS STEEL AND SPECIAL MATERIALS
SCREWED OR SOCKET WELD ENDS - FULL PORT



Gate Valves
type BSC 800 FB



Globe & Needle Valves
type BBD 0800 FB
* Button head up to ND 25 size



Swing Check Valves
type CKB 800 FB
or Piston Check Valves type CKP 800 FB
or Ball Check Valves type CKS 800 FB

CLASS	ND mm.	OUR TYPE	END TO END 'A' mm.	PORT DIAM. 'C' mm.
	8	**BSC 801 FB**	60.3	6.5
800 Lbs	10	**BSC 802 FB**	60.3	8
	15	**BSC 803 FB**	89	12.7
• 138 bar at	20	**BSC 804 FB**	105	19
- 30 + 38°c	25	**BSC 805 FB**	127	24
	40	**BSC 807 FB**	171.4	38
	50	**BSC 808 FB**	184	50
800 Lbs	8	**BBD 0801 FB**	60.3	06.5
	10	**BBD 0802 FB**	60.3	7
• 138 bar at	15	**BBD 0803 FB**	89	12
- 30 + 38°c	20	**BBD 0804 FB**	105	17.5
	25	**BBD 0805 FB**	127	22
	40	**BBD 0807 FB**	171.4	32
	50	**BBD 0808 FB**	184	44.4
	15	**CKB 803 FB**	89	12
800 Lbs	20	**CKB 804 FB**	105	17.5
	25	**CKB 805 FB**	127	22
• 138 bar at	40	**CKB 807 FB**	171.4	32
- 30 + 38°C	50	**CKB 808 FB**	184	44.4
800 Lbs	8	**CKP 801 FB**	60.3	6. 5
	10	**CKP 802 FB**	60.3	7
• 138 bar at	15	**CKP 803 FB**	89	12
-30 + 38°C	20	**CKP 804 FB**	105	17.5
	25	**CKP 805 FB**	127	22
	40	**CKP 807 FB**	171.4	32
	50	**CKP 808 FB**	184	44.4
	8	**CKS 801 FB**	60.3	6.5
800 Lbs	15	**CKS 802 FB**	60.3	7
	20	**CKS 803 FB**	89	12
• 138 bar at	25	**CKS 804 FB**	105	17.5
-30 + 38°C	30	**CKS 805 FB**	127	22
	40	**CKS 807 FB**	171.4	32
	50	**CKS 808 FB**	184	44.4

BODY MATERIAL

A	A105
B	A182 GR F1
C	A182 GR F5
D	A182 Gr F9
E	A182 Gr. F11
F	A182 Gr F12
G	A182 Gr F22
H	A182 Gr F304
I	A182 Gr F304L
L	A182 Gr F316
M	A182 Gr F316L
N	A182Gr F321
O	A182 Gr F347
P	A350 Gr LF2
Q	A350 Gr LF3
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
Y	UNS N08904
K	Duplex 2205
J	254 SMO

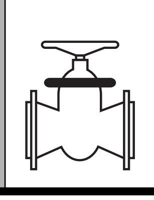
TRIM MATERIAL

A	13% CR
B	13% Cr St
H	A182-F304
D	A182-F304 St
L	A182-F316
F	A182-F316 St
N	A182-F321
P	A182-F321 St
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
Y	UNS N08904
J	UNS N08904 St
X	Hastelloy C
M	A 182-F316L
C	Bronze
Q	Monel PTFE
E	Soft Seal
K	Duplex 2205
V	254 SMO

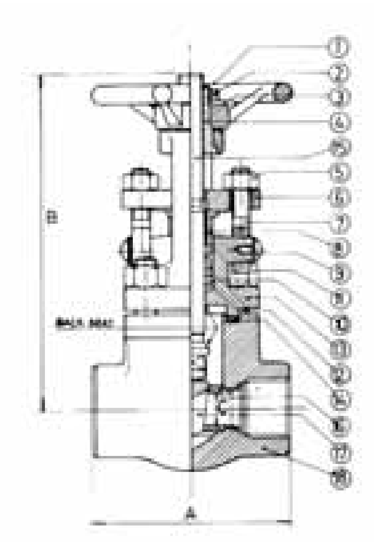
St = Stellite

Ref.	Part. Name
32	REGULATING NEEDLE
21	RING IN TWO HALVES
20	DISC NUT
19	YOKE RETAINING NUT
18	BODY
17	DISC
16	SEAT
15	STEM
14	GASKET
13	BONNET
12	STUD BOLTS
11	NUT
10	PACKING
9	EYEBOLTS UNIT
8	PACKING GLAND
7	EYEBOLTS
6	GLAND FLANGE
5	NUT
4	YOKE NUT
3	NAME PLATE
2	BOLT
1	HANDWHEEL

Note: For reference to items number add to the base drawing number a stroke then item no.
i.e BSC 803 FB/18 means body for Gate Valve class 800 FB. Size 15 mm.
• RATING FOR CARBON STEEL TO ANSI B 16.34 EDITION 1977
Standard API 602 & BS 5352



FORGED STEEL GATE, GLOBE, CHECK VALVES
CARBON, ALLOY, STAINLESS STEEL AND SPECIAL MATERIALS
SCREWED OR SOCKED WELD ENDS – REDUCED PORT



Gate Valves
Type BSC 800 RB

CLASS	ND mm.	OUR TYPE	END TO END 'A' mm.	PORT DIAM. 'C' mm.
800 Lbs	15	**BSC 803 RB**	70	11
	20	**BSC 804 RB**	89	12.7
• 138 bar at	25	**BSC 805 RB**	105	19
-30 + 38° C	40	**BSC 807 RB**	140	30
	50	**BSC 808 RB**	171.4	38
800 Lbs	15	**BBD 0803 RB**	70	7
	20	**BBD 0804 RB**	89	12
• 138 bar at	25	**BBD 0805 RB**	105	17.5
- 30 + 38° C	40	**BBD 0807 RB**	140	29
	50	**BBD 0808 RB**	171.4	32
800 Lbs	15	**CKP 803 RB**	70	7
	20	**CKP 804 RB**	89	12
• 138 bar at	25	**CKP 805 RB**	105	17.5
- 30 + 38° C	40	**CKP 807 RB**	140	29
	50	**CKP 808 RB**	171.4	32
800 Lbs	15	**CKS 803 RB**	70	7
	20	**CKS 804 RB**	89	12
• 138 bar at	25	**CKS 805 RB**	105	17.5
-30 + 38° C	40	**CKS 807 RB**	140	29
	50	**CKS 808 RB**	171.4	32

BODY MATERIAL

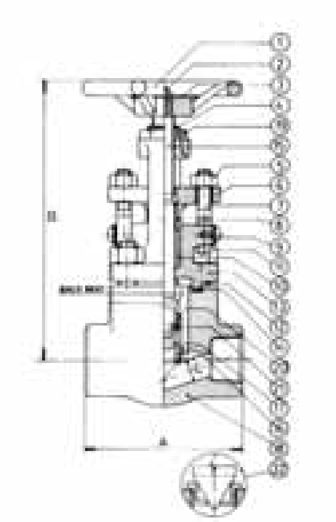
A	105
B	A182 GR F1
C	A182 GR F5
D	A182 Gr F9
E	182 Gr. F11
F	A182 Gr F12
G	A182 Gr F22
H	A182 Gr F304
I	A182 Gr F304L
L	A182 Gr F316
M	A182 Gr F316L
N	A182Gr F321
O	A182 Gr F347
P	A350 Gr LF2
Q	A350 Gr LF3
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
Y	UNS N08904
K	Duplex 2205
J	254 SMO

TRIM MATERIAL

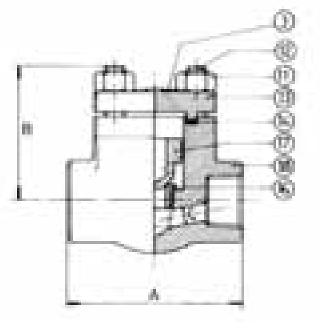
A	13% CR
B	13% Cr St
H	A182-F304
D	A182-F304 St
L	A182-F316
F	A182-F316 St
N	A182-F321
P	A182-F321 St
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
Y	UNS N08904
J	UNS N08904 St
X	Hastelloy C
M	A 182-F316L
C	Bronze
Q	Monel PTFE
E	Soft Seal
K	Duplex 2205
V	254 SMO

St = Stellite

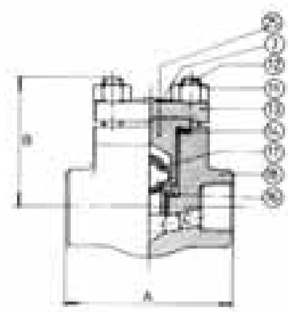
Ref.	Part. Name
32	REGULATING NEEDLE
21	RING IN TWO HALVES
20	DISC NUT
19	YOKE RETAINING NUT
18	BODY
17	DISC
16	SEAT
15	STEM
14	GASKET
13	BONNET
12	STUD BOLTS
11	NUT
10	PACKING
9	EYEBOLTS UNIT
8	PACKING GLAND
7	EYEBOLTS
6	GRAND FLANGE
5	NUT
4	YOKE NUT
3	NAME PLATE
2	BOLT
1	HANDWHEEL



Globe & Needle Valves
type BBD 0800 RB
*Button head up to
ND 25 size



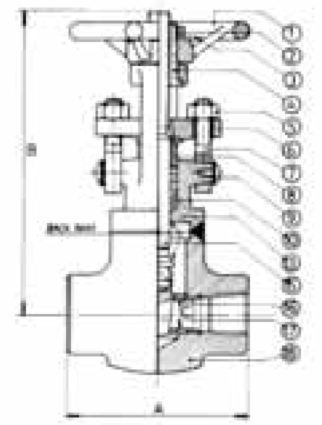
Piston Check Valves
type CKP 800 RB



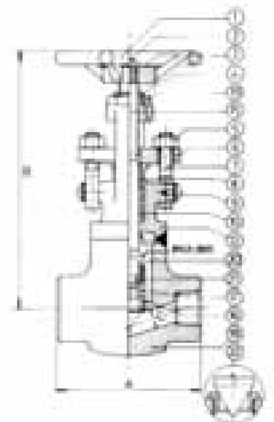
Ball Check Valves
type CKS 800 RB

Note: For reference to items number add to the base drawing number a stroke then item no.
i.e BSC 803 RB/18 means body for Gate Valve BSC 800 RB. Size 15 mm.
• RATING FOR CARBON STEEL TO ANSI B 16.34 EDITION 1977
STANDARD API 602 & BS 5352

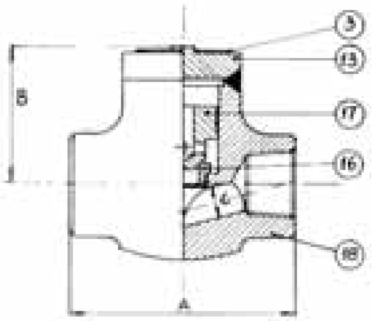
FORGED STEEL GATE, GLOBE, CHECK VALVES
CARBON, ALLOY, STAINLESS STEEL AND SPECIAL MATERIALS
SCREWED OR SOCKET WELD ENDS
FULL PENETRATION WELDED BONNET – REDUCED OR FULL PORT



Gate Valves
type WSC 800 RB
or WSC 800 FB



Globe & Needle Valves
type WBD 0800 RB
or WBD 0800 FB
Button head up to
ND 25 size



Piston Check Valves
type WCKP 800 RB
or WCKP 800 FB

CLASS	ND mm.	OUR TYPE	END TO END 'A' mm.	PORT DIAM. 'C' mm.
	15	**WSC 803 RB**	70	11
800 Lbs	20	**WSC 804 RB**	89	12.7
	25	**WSC 805 RB**	105	19
• 138 bar at	40	**WSC 807 RB**	140	30
- 30 + 38° C	50	**WSC 808 RB**	171.4	38
	8	**WSC 801 FB**	60.3	6.5
	10	**WSC 802 FB**	60.3	8
800 Lbs	15	**WSC 803 FB**	89	12.7
	20	**WSC 804 FB**	105	19
• 138 bar at	25	**WSC 805 FB**	127	24
- 30 + 38° C	40	**WSC 807 FB**	171.4	38
	50	**WSC 808 FB**	184	50
	15	**WBD 0803 RB**	70	7
800 Lbs	20	**WBD 0804 RB**	89	12
	25	**WBD 0805 RB**	105	17.5
• 138 bar at	40	**WBD 0807 RB**	140	29
- 30 + 38° C	50	**WBD 0808 RB**	171.4	32
	8	**WBD 0801 FB**	60.3	6.5
	10	**WBD 0802 FB**	60.3	7
800 Lbs	15	**WBD 0803 FB**	89	12
	20	**WBD 0804 FB**	105	17.5
• 138 bar at	25	**WBS 0805 FB**	127	22
-30 + 38° C	40	**WBD 0807 FB**	171.4	32
	50	**WBD 0808 FB**	184	44.4
	15	**WCKP 803 RB**	70	7
800 Lbs	20	**WCKP 804 RB**	89	12
	25	**WCKP 805 RB**	105	17.5
• 138 bar at	40	**WCKP 807 RB**	140	29
-30 + 38° C	50	**WCKP 808 RB**	172	32
	15	**WCKP 803 FB**	89	12
800 Lbs	20	**WCKP 804 FB**	105	17.5
	25	**WCKP 805 FB**	127	22
• 138 bar at	40	**WCKP 807 FB**	172	32
- 30 + 38° C	50	**WCKP 808 FB**	184	44

BODY MATERIAL

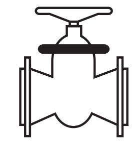
A	A105
B	A182 GR F1
C	A182 GR F5
D	A182 Gr F9
E	A182 Gr. F11
F	A182 Gr F12
G	A182 Gr F22
I	A182 Gr F304L
L	A182 Gr F316
M	A182 Gr F316L
N	A182Gr F321
O	A182 Gr F347
P	A350 Gr LF2
Q	A350 Gr LF3
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
Y	UNS N08904
K	Duplex 2205
J	254 SMO

TRIM MATERIAL

A	13% CR
B	13% Cr St
H	A182-F304
D	A182-F304 St
L	A182-F316
F	A182-F316 St
N	A182-F321
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
Y	UNS N08904
J	UNS N08904 St
X	Hastelloy C
M	A 182-F316L
C	Bronze
Q	Monel PTFE
E	Soft Seal
K	Duplex 2205
V	254 SMO

Ref.	Part. Name
32	REGULATING NEEDLE
21	RING IN TWO HALVES
20	DISC NUT
19	YOKE RETAINING NUT
18	BODY
17	DISC
16	SEAT
15	STEM
13	BONNET
10	PACKING
9	EYEBOLTS UNIT
8	PACKING GLAND
7	EYEBOLTS
6	GRAND FLANGE
5	NUT
4	YOKE NUT
3	NAME PLATE
2	BOLT
1	HANDWHEEL

Note: For reference to items number add to the base drawing number a stroke then item no.
i.e WSC 803 RB/18 means body for Gate Valve WSC 800 RB. Size 15 mm.
• RATING FOR CARBON STEEL TO ANSI B 16.34 EDITION 1977
STANDARD API 602 & BS 5352



FORGED GATE VALVES
CARBON, ALLOY, STAINLESS STEEL AND SPECIAL MATERIALS
SCREWED, BEVELED END FOR WELDING, SOCKET WELD ENDS
REINFORCED EXTENSION

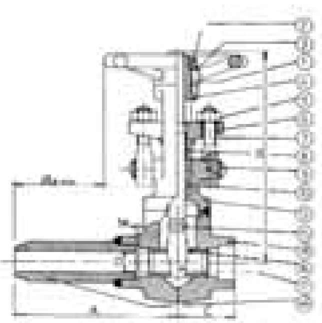
CLASS	ND mm.	OUR TYPE	END TO END 'A' mm.	PORT DIAM. 'C' mm.
800 Lbs	15	**WSC 6063**	142	11
	20	**WSC 6064**	161.5	12.7
• 138 bar at	25	**WSC 6065**	182.5	19
-30 + 38° C	40	**WSC 6067**	214	30
800 Lbs	15	**WSC 6063 R**	207	11
	20	**WSC 6064 R**	218.5	12.7
• 138 bar at	25	**WSC 6065 R**	243.5	19
- 30 + 38° C	40	**WSC 6067 R**	263	30
800 Lbs	15	**WSC 15063**	156	11
	20	**WSC 15064**	180	12.7
• 255 bar at	25	**WSC 15065**	198.5	19
- 30 + 38° C	40	**WSC 15067**	236	30

BODY MATERIAL

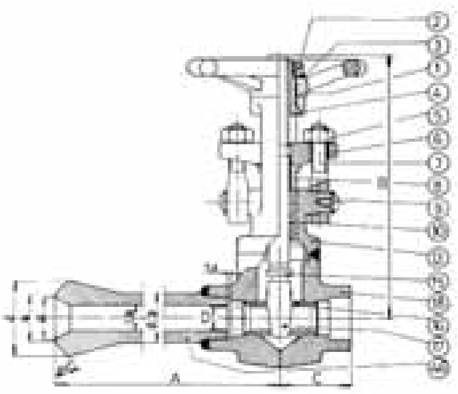
A	A 105
B	A182 GR F1
C	A182 GR F5
D	A182 Gr F9
E	182 Gr. F11
F	A182 Gr F12
G	A182 Gr F22
H	A182 Gr F304
I	A182 Gr F304L
L	A182 Gr F316
M	A182 Gr F316L
N	A182Gr F321
O	A182 Gr F347
P	A350 Gr LF2
Q	A350 Gr LF3
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
Y	UNS N08904
K	Duplex 2205
J	254 SMO

TRIM MATERIAL

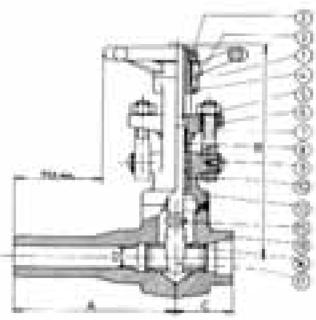
A	13% CR
B	13% Cr St
H	A182-F304
D	A182-F304 St
L	A182-F316
F	A182-F316 St
N	A182-F321
P	A182-F321 St
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
Y	UNS N08904
J	UNS N08904 St
X	Hastelloy C
M	A 182-F316L
C	Bronze
Q	Monel PTFE
E	Soft Seal
K	Duplex 2205
V	254 SMO



Gate Valves
Type WSC 1506



Gate Valves
Reinforced
type WSC 606 R

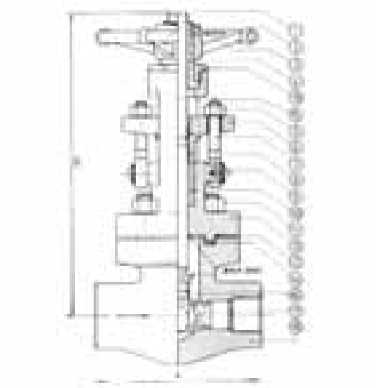


Gate Valves
type WSC 606 I

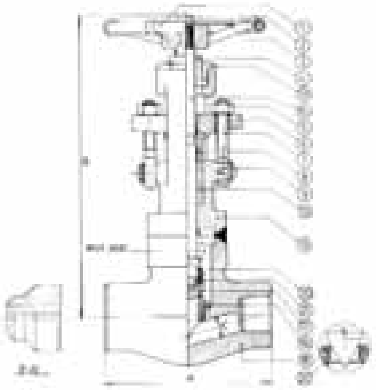
Ref.	Part. Name
46	BODY EXTENSION
18	BODY
17	DISC
16	SEAT
15	STEM
13	BONNET
10	PACKING
9	EYEBOLTS UNIT
8	PACKING GLAND
7	EYEBOLTS
6	GLAND FLANGE
5	NUT
4	YOKE NUT
3	NAME PLATE
2	BOLT
1	HANDWHEEL

Note: For reference to items number add to the base drawing number a stroke then item no.
i.e WSC 6063/18 means body for Gate Valves Extended Body API 606. Size 15 mm.
• RATING FOR CARBON STEEL TO ANSI B 16.34 EDITION 1977
STANDARD API 602 & BS 5352

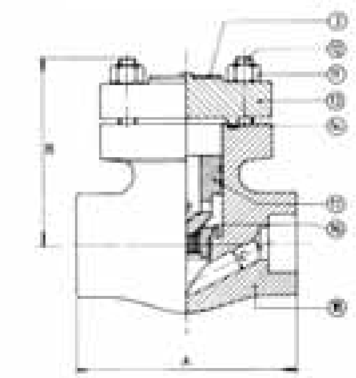
FORGED GATE, GLOBE, CHECK VALVES
CARBON, ALLOY, STAINLESS STEEL AND SPECIAL MATERIALS
SCREWED OR SOCKET WELD ENDS
FULL PENETRATION WELDED BONNET



Gate Valves
type BSC 1500
or Globe Valves
type BBD 01500



Globe Valves
type WBD 01500
* Button head up to
ND 20 size
Gate Valves
type WSC 1500



Piston Check Valves
type CKP 1500
or Swing Check Valves
type CKS 1500
or Ball Check Valves
type CKB 1500

CLASS	ND mm.	OUR TYPE	END TO END 'A' mm.	PORT DIAM. 'C' mm.
1500 Lbs	15	**BSC 1503**	92	11
	20	**BSC 1504**	114.3	13. 5
BB-O.S.&Y.	25	**BSC 1505**	127	19
• 255 bar at	40	**BSC 1507**	171.4	30
- 30 + 38° C	50	**BSC 1508**	228.6	38
1500 Lbs	15	**BBD 01503**	92	12
	20	**BBD 01504**	114.3	14. 3
BB-O.S.&Y.	25	**BBD 01505**	127	19
• 255 bar at	40	**BBD 01507**	171.4	28
- 30 + 38° C	50	**BBD 01508**	228.6	40
1500 Lbs	15	**WSC 01503**	89	11
	20	**WSC 01504**	105	13. 5
WB-O.S.&Y.	25	**WSC 01505**	127	19
• 255 bar at	40	**WSC 01507**	171,4	30
- 30 + 38° C	50	**WSC 01508**	184	38
1500 Lbs	15	**WBD 01503**	89	12
	20	**WBD 01504**	105	14. 3
WB-O.S.&Y.	25	**WBS 01505**	127	19
• 255 bar at	40	**WBD 01507**	171.4	28
-30 + 38° C	50	**WBD 01508**	184	40
1500 Lbs	15	**CKP 1503**	92	12
	20	**CKP 1504**	114	17. 5
BB-O.S.&Y.	25	**CKP 1505**	127	22
• 255 bar at	40	**CKP 1507**	172	32
-30 + 38°C	50	**CKP 1508**	229	44.4
1500 Lbs	15	**CKS 1503**	92	12
	20	**CKS 1504**	114	17. 5
BB-O.S.&Y.	25	**CKS 1505**	127	22
• 138 bar at	40	**CKS 1507**	172	32
- 30 + 38° C	50	**CKS 1508**	229	44.4
1500 Lbs	15	**CKS 1503**	92	12
	20	**CKS 1504**	114	17. 5
BB-O.S.&Y.	25	**CKS 1505**	127	22
• 138 bar at	40	**CKS 1507**	172	32
- 30 + 38° C	50	**CKS 1508**	229	44.4

BODY MATERIAL

A	A105
B	A182 GR F1
C	A182 GR F5
D	A182 Gr F9
E	A182 Gr. F11
F	A182 Gr F12
G	A182 Gr F22
H	A182 Gr F304
I	A182 Gr F304L
L	A182 Gr F316
M	A182 Gr F316L
N	A182 Gr F321
O	A182 Gr F347
P	A350 Gr LF2
Q	A350 Gr LF3
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
Y	UNS N08904
K	Duplex 2205
J	254 SMO

TRIM MATERIAL

A	13% CR
B	13% Cr St
H	A182-F304
D	A182-F304 St
L	A182-F316
F	A182-F316 St
N	A182-F321
P	A182-F321 St
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
Y	UNS N08904
J	UNS N08904 St
X	Hastelloy C
M	A 182-F316L
C	Bronze
Q	Monel PTFE
E	Soft Seal
K	Duplex 2205
V	254 SMO

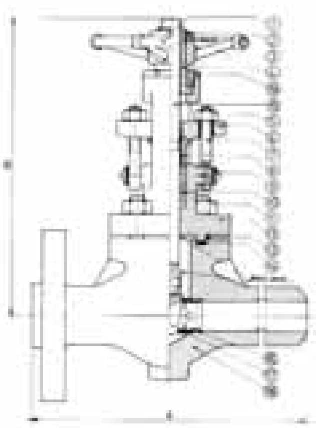
St = Stellite

Ref.	Part. Name
32	REGULATING NEEDLE
21	RING IN TWO HALVES
20	DISC NUT
19	YOKE RETAINING NUT
18	BODY
17	DISC
16	SEAT
15	STEM
13	BONNET
10	PACKING
9	EYEBOLTS UNIT
8	PACKING GLAND
7	EYEBOLTS
6	GRAND FLANGE
5	NUT
4	YOKE NUT
3	NAME PLATE
2	BOLT
1	HANDWHEEL

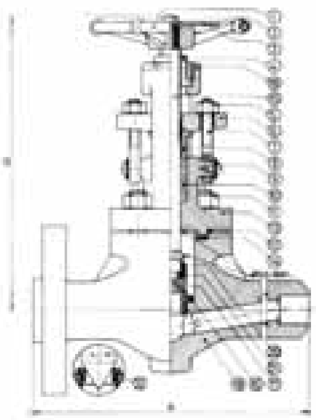
Note: For reference to items number add to the base drawing number a stroke then item no. i.e BSC 1503/18 means body for Gate Valve screwed or socket weld ends. Size 15 mm.

• RATING FOR CARBON STEEL TO ANSI B 16.34 EDITION 1977
BRITISH STANDARD 5352

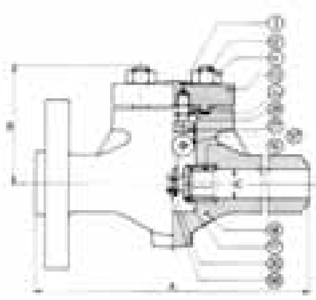
FORGED GATE, GLOBE AND CHECK VALVES
BOLTED BONNET, O.S. & Y.
CARBON, ALLOY, STAINLESS STEEL AND SPECIAL MATERIALS
FLANGES INTEGRALLY FORGED WITH BODY CLASS 150 – 300 – 600 LBS



Gate Valves
type SCF 600
or SCF 300
or SCF 150



Globe & Needle Valves
type DF 0600
or DF 0300
or DF 0150
* Button head up to
ND 25 size



Swing Check Valves
type CKBF 0600
or CKBF 300

CLASS	ND mm.	OUR TYPE	END TO END 'A' mm.	PORT DIAM. 'C' mm.
150 Lbs	15	**SCF 153**	108	11
	20	**SCF 154**	118	12.7
• 19.5 bar at	25	**SCF 155**	127	19
-30 + 38° C	40	**SCF 157**	165	30
	50	**SCF 158**	178	38
300 Lbs	15	**SCF 303**	140	12.7
• 51 bar at	25	**SCF 305**	165	24
-30 + 38° C	40	**SCF 307**	190.5	38
	50	**SCF 308**	216	50
600 Lbs	15	**SCF 603**	165	12.7
	20	**SCF 604**	190.5	19
• 102 bar at	25	**SCF 605**	216	24
-30 + 38° C	40	**SCF 607**	241	38
	50	**SCF 608**	292	50
150 Lbs	15	**DF 0153**	108	7
	20	**DF 0154**	117.5	12
• 19.5 bar at	25	**DF 0155**	127	17.7
- 30 + 38° C	40	**DF 0157**	165	29
	50	**DF 0158**	203	32
300 Lbs	15	**DF 0303**	152.4	12
	20	**DF 0304**	177.8	17.5
• 51 bar at	25	**DF 0305**	203.2	22
-30 + 38° C	40	**DF 0307**	228.6	29
	50	**DF 0308**	266.7	40
600 Lbs	15	**DF 0603**	165	12
	20	**DF 0604**	190.5	17.5
• 102 bar at	25	**DF 0605**	216	22
-30 + 38° C	40	**DF 0607**	241	29
	50	**DF 0608**	292	40
300 Lbs	15	**CKBF 303**	165	12
	20	**CKBF 304**	190.5	17.5
• 51 bar at	25	**CKBF 305**	216	22
- 30 + 38° C	40	**CKBF 307**	241	32
	50	**CKBF 308**	266.7	44.4
600 Lbs	15	**CKBF 603**	165.1	12
	20	**CKBF 604**	190.5	17.5
• 102 bar at	25	**CKBF 605**	216	22
- 30 + 38° C	40	**CKBF 607**	241	32
	50	**CKBF 608**	292	44.4

BODY MATERIAL

A	A105
B	A182 GR F1
C	A182 GR F5
D	A182 Gr F9
E	A182 Gr. F11
F	A182 Gr F12
G	A182 Gr F22
H	A182 Gr F304
I	A182 Gr F304L
L	A182 Gr F316
M	A182 Gr F316L
N	A182 Gr F321
O	A182 Gr F347
P	A350 Gr LF2
Q	A350 Gr LF3
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
Y	UNS N08904
K	Duplex 2205
J	254 SMO

TRIM MATERIAL

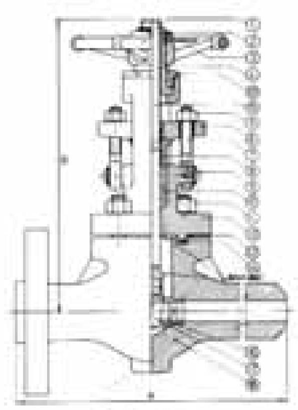
A	13% CR
B	13% Cr St
H	A182-F304
D	A182-F304 St
L	A182-F316
F	A182-F316 St
N	A182-F321
P	A182-F321 St
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
Y	UNS N08904
J	UNS N08904 St
X	Hastelloy C
M	A 182-F316L
C	Bronze
Q	Monel PTFE
E	Soft Seal
K	Duplex 2205
V	254 SMO

St = Stellite

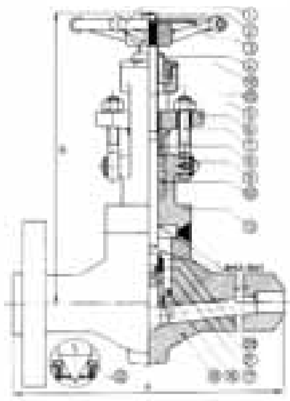
Ref.	Part. Name
32	REGULATING NEEDLE
21	RING IN TWO HALVES
20	DISC NUT
19	YOKE RETAINING NUT
18	BODY
17	DISC
16	SEAT
15	STEM
14	GASKET
13	BONNET
12	STUD BOLTS
11	NUT
10	PACKING
9	EYEBOLTS UNIT
8	PACKING GLAND
7	EYEBOLTS
6	GRAND FLANGE
5	NUT
4	YOKE NUT
3	NAME PLATE
2	BOLT
1	HANDWHEEL

Note: For reference to items number add to the base drawing number a stroke then item no.
i.e SCF 153/18 means body for Gate Valves flanged ANSI 150. Size 15 mm.
• RATING FOR CARBON STEEL TO ANSI B 16.34 EDITION 1977
STANDARD API 602 & BS 5352

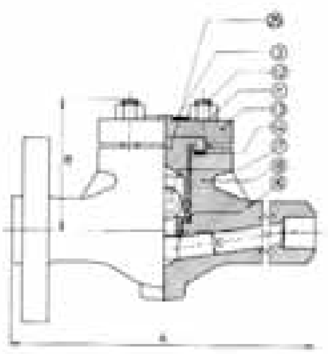
FORGED STEEL GATE, GLOBE, CHECK VALVES
CARBON, ALLOY, STAINLESS STEEL AND SPECIAL MATERIALS
FLANGES INTEGRALLY FORGED WITH BODY
BOLTED BONNET OR FULL PENETRATION WELDED BONNET



Gate Valves
type SCF 1500
or WSCF 1500



Globe Valves
type WDF 01500
or DF 01500
* Button head up to
ND 20 size



Ball Check Valves
type CKSF 1500
or Piston Check Valves
type CKPF 1500
or Swing Check Valves
type CKBF 1500

CLASS	ND mm.	OUR TYPE	END TO END 'A' mm.	PORT DIAM. 'C' mm.
1500 Lbs	15	**SCF 1503**	216	12.7
	20	**SCF 1504**	228.6	19
• 255 bar at	25	**SCF 1505**	254	24
-30 + 38° C	40	**SCF 1507**	305	38
1500 Lbs	15	**WSCF 1503**	216	12.7
	20	**WSCF 1504**	228.6	19
• 255 bar at	25	**WSCF 1505**	254	24
- 30 + 38° C	40	**WSCF 1507**	305	38
1500 Lbs	15	**DF 01503**	216	12
	20	**DF 01504**	228.6	17.5
• 255 bar at	25	**DF 01505**	254	22
- 30 + 38° C	40	**DF 01507**	305	29
1500 Lbs	15	**WDF 01503**	216	12
	20	**WDF 01504**	228.6	17.5
• 255 bar at	25	**WDF 01505**	254	22
-30 + 38° C	40	**WDF 01507**	305	29
1500 Lbs	15	**CKPF 1503**	216	12
	20	**CKPF 1504**	229	17.5
• 255 bar at	25	**CKPF 1505**	254	22
-30 + 38°C	40	**CKPF 1507**	305	29
1500 Lbs	15	**CKSF 1503**	216	12
	20	**CKSF 1504**	229	17.5
• 255 bar at	25	**CKSF 1505**	254	22
- 30 + 38° C	40	**CKSF 1507**	305	29
1500 Lbs	15	**CKBF 1503**	216	12
	20	**CKBF 1504**	228.6	17.5
• 255 bar at	25	**CKBF 1505**	254	22
- 30 + 38° C	40	**CKBF 1507**	305	32

BODY MATERIAL

A	A105
B	A182 GR F1
C	A182 GR F5
D	A182 Gr F9
E	A182 Gr. F11
F	A182 Gr F12
G	A182 Gr F22
H	A182 Gr F304
I	A182 Gr F304L
L	A182 Gr F316
M	A182 Gr F316L
N	A182 Gr F321
O	A182 Gr F347
P	A350 Gr LF2
Q	A350 Gr LF3
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
Y	UNS N08904
K	Duplex 2205
J	254 SMO

TRIM MATERIAL

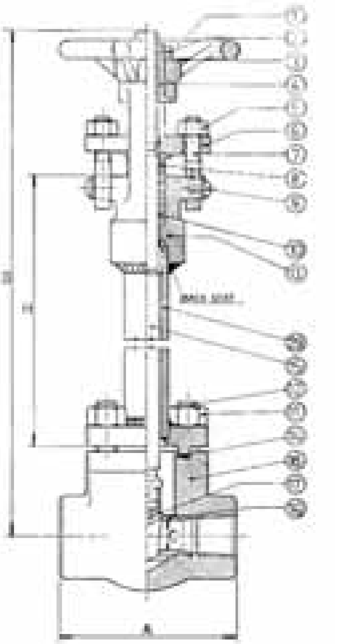
A	13% CR
B	13% Cr St
H	A182-F304
D	A182-F304 St
L	A182-F316
F	A182-F316 St
N	A182-F321
P	A182-F321 St
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
Y	UNS N08904
J	UNS N08904 St
X	Hastelloy C
M	A 182-F316L
C	Bronze
Q	Monel PTFE
E	Soft Seal
K	Duplex 2205
V	254 SMO

St = Stellite

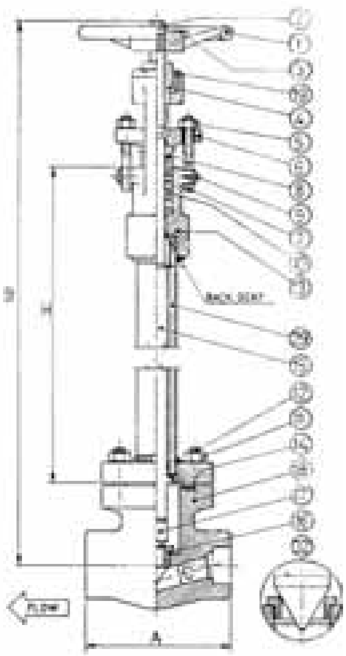
Ref.	Part. Name
32	REGULATING NEEDLE
21	RING IN TWO HALVES
20	DISC NUT
19	YOKE RETAINING NUT
18	BODY
17	DISC
16	SEAT
15	STEM
13	BONNET
10	PACKING
9	EYEBOLTS UNIT
8	PACKING GLAND
7	EYEBOLTS
6	GRAND FLANGE
5	NUT
4	YOKE NUT
2	BOLT
1	HANDWHEEL

Note: For reference to item numbers add to the base drawing number a stroke then item no.
i.e SCF 1503/18 means body for Gate Valve flanged RF. Size 15 mm.
• RATING FOR CARBON STEEL TO ANSI B 16.34 EDITION 1977
BRITISH STANDARD BS 5352

FORGED GATE AND GLOBE VALVES
IN STAINLESS STEEL
SCREWED OR SOCKED WELD ENDS



Cryogenic Gate Valves
type BSC 800 BT
or Globe Valves
tpe BBD 0800 BT



Cryogenic Globe Valves
type BBD 01500 BT
or Gate Valves
type BSC 1500 BT
* Button head up to
ND 25 size

CLASS	ND mm.	OUR TYPE	END TO END 'A' mm.	PORT DIAM. 'C' mm.
800 Lbs	15	**BSC 803 BT**	89	12.7
	20	**BSC 804 BT**	105	19
99 bar at	25	**BSC 805 BT**	127	24
cold non shock	40	**BSC 807 BT**	172	38
- 196° C	50	**BSC 808 BT**	184	50
800 Lbs	15	**BBD 0803 BT**	89	12
	20	**BBD 0804 BT**	105	17.5
99 bar at	25	**BBD 0805 BT**	127	22
cold non shock	40	**BBD 0807 BT**	172	29
- 196° C	50	**BBD 0808 BT**	184	40
1500 Lbs	15	**BSC 1503 BT**	92	12.7
	20	**BSC 1504 BT**	114	19
248 bar at	25	**BSC 1505 BT**	127	24
- 196° C	40	**BSC 1507 BT**	172	38
	50	**BSC 1508 BT**	228.6	50
1500 Lbs	15	**BBD 01503 BT**	92	12
	20	**BBD 01504 BT**	114	17.5
248 bar at	25	**BBD 01505 BT**	127	22
- 196° C	40	**BBD 01507 BT**	172	29
	50	**BBD 01508 BT**	228.6	40

BODY MATERIAL

H	A182 GR. F304
I	A182 GR F304L
L	A182 GR F316
M	A182 Gr F316L
N	A182 Gr F321
O	A182 Gr F347
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
K	Duplex 2205

TRIM MATERIAL

H	A182-F304
D	A182-F304 St
L	A182-F316
F	A182-F316 St
N	A182-F321
P	A182-F321 St
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
X	Hastelloy C
M	A182-F316L
C	Bronze
Q	Monel PTFE
E	Soft Seal

St = Stellite

Ref.	Part. Name
32	REGULATING NEEDLE
29	EXTENSION PIPE
19	YOKE RETAINING NUT
18	BODY
17	DISC
16	SEAT
15	STEM
14	GASKET
13	BONNET
12	STUD BOLTS
11	NUT
10	PACKING
9	EYEBOLTS UNIT
8	PACKING GLAND
7	EYEBOLTS
6	GRAND FLANGE
5	NUT
4	YOKE NUT
3	NAME PLATE
2	BOLT
1	HANDWHEEL

Note: For reference to items number add to the base drawing number a stroke then item no.
i.e BSC 803 BT/18 means body for Gate Valve 800 Lbs. Size 15 mm.
British standard 5352

FORGED GATE AND GLOBE VALVES
IN STAINLESS STEEL
FLANGES INTEGRALLY FORGED WITH BODY

CLASS	ND mm.	OUR TYPE	END TO END 'A' mm.	PORT DIAM. 'C' mm.
300 Lbs	15	**SCF 303 BT**	140	12.7
	20	**SCF 304 BT**	152.4	19
49.6 bar at	25	**SCF 305 BT**	165	24
- 196° C	40	**SCF 307 BT**	191	38
	50	**SCF 308 BT**	216	50
600 Lbs	15	**SCF 603 BT**	165	12.7
	20	**SCF 604 BT**	190.5	19
99 bar at	25	**SCF 605 BT**	216	24
- 196° C	40	**SCF 607 BT**	241	38
	50	**SCF 608 BT**	292	50
300 Lbs	15	**DF 0303 BT**	152	12
	20	**DF 0304 BT**	178	17.5
49 bar at	25	**DF 0305 BT**	203	22
- 196° C	40	**DF 0307 BT**	229	29
	50	**DF 0308 BT**	267	40
600 Lbs	15	**DF 0603 BT**	165	12
	20	**DF 0604 BT**	190.5	17.5
99 bar at	25	**DF 0605 BT**	216	22
- 196° C	40	**DF 0607 BT**	241	29
	50	**DF 0608 BT**	292	40

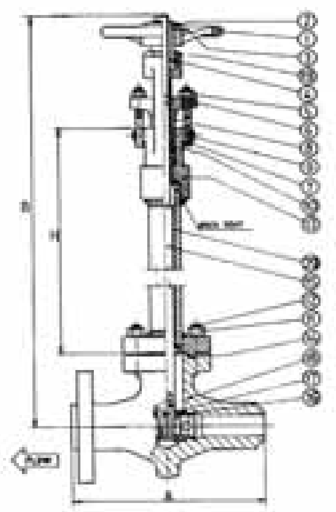
BODY MATERIAL

Code	Material
H	A182 GR. F304
I	A182 GR F304L
L	A182 GR F316
M	A182 Gr F316L
N	A182 Gr F321
O	A182 Gr F347
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
K	Duplex 2205

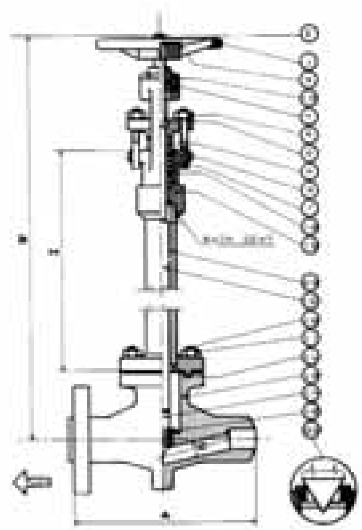
TRIM MATERIAL

Code	Material
H	A182-F304
D	A182-F304 St
L	A182-F316
F	A182-F316 St
N	A182-F321
P	A182-F321 St
R	Monel
S	Inconel
T	Titanium
U	Incoloy 825
X	Hastelloy C
M	A182-F316L
C	Bronze
Q	Monel PTFE
E	Soft Seal

St = Stellite



Cryogenic Gate Valves
type SCF 300 BT
or SCF 600 BT



Cryogenic Globe Valves
type DF 0300 BT
or DF 0600 BT
* Button head up to
ND 25 size

Ref.	Part. Name
32	REGULATING NEEDLE
29	EXTENSION PIPE
19	YOKE RETAINING NUT
18	BODY
17	DISC
16	SEAT
15	STEM
14	GASKET
13	BONNET
12	STUD BOLTS
11	NUT
10	PACKING
9	EYEBOLTS UNIT
8	PACKING GLAND
7	EYEBOLTS
6	GRAND FLANGE
5	NUT
4	YOKE NUT
3	NAME PLATE
2	BOLT
1	HANDWHEEL

Note: For reference to items number add to the base drawing number a stroke then item no.
i.e SCF 603 BT/18 means body for Gate Valve 600 Lbs. Size 15 mm.
British standard 5352



EXTRACT OF COMPARISION OF STANDARDS

CHEMICAL ANALYSIS

DIN EN 10 088-2

Vergleich mit verschiedenen Normen

USA AISI	JAPAN JIS	GUS GOST	Werk-Stoff-Nr.	Kurzname	Delivery con-dition*	C % max.	SI % max.	MN % max.
			1.4003	X2CrNi12	K	0.03	1.00	1.50
					W			
			1.4512	X2CrTi12	K	0.03	1.00	1.00
					W			
409	SUS 409		1.4000	X6Cr13	K	0.08	1.00	1.00
					W			
410S	SUS410S	08Ch13	1.4002	X6CrAl13	K	0.08	1.00	1.00
					W			
405	SUS405	1.4006	X12Cr13		K	0.08-0.15	1.00	1.50
					W			
410	SUS410	12Ch13	1.4021	X20Cr13	K	0.16-0.25	1.00	1.50
					W			
(420)	SUS420J1	20Ch13	1.4031	X39Cr13	K	0.36-0.42	1.00	1.00
					W			
(420)		40Ch13	1.4016	X6Cr17	K	0.08	1.00	1.00
					W			
430	SUS430	12Ch17	1.4520	X2CrTi17	K	0.025	0.50	0.50
					W			
		1.4510	X3CrTi17		K	0.05	1.00	1.00
					W			
304	SUS304	08Ch18N10	1.4301	X5CrNi18-10	K	0.07	1.00	2.00
					W			
304L	SUS304L	03Ch18N11	1.4306	X2CrNi19-11	K	0.03	1.00	2.00
					W			
321	SUS321	08Ch18N10T	1.4541	X6CrNiTi18-10	K	0.08	1.00	2.00
					W			
347	SUS347	08Ch18N12B	1.4550	X6CrNiNb18-10	K	0.08	1.00	2.00
					W			
316	SUS316	03Ch17M13M2	1.4401	X5CrNiMo17-12-2	K	0.07	1.00	2.00
					W			
316L	SUS316L	03Ch17N13M2	1.4404	X2CrNiMo17-12-2	K	0.03	1.00	2.00
					W			
316Ti	SUS316Ti	10 Ch17N13	1.4571	X6CrNiMoTi17-12-2	K	0.08	1.00	2.00
	M2T				W			

*K = cold rolled; W = hot rolled

Cr %	Mo %	Ni %	Others % Rp 0.2	0.2%- YS Rm N/mm_ min.	TS N/mm_
10.50-12.50		0.30-1.00	N:0.030	320	450-650
				320	450-650
10.50-12.50			6x(C+N)Ti0.65	220	380-560
				220	380-560
12.00-14.00				250	400-600
				230	400-600
12.00-14.00			Al:0.10-0.30	250	400-600
				230	400-600
11.50-13.50		0.75			max. 600
					max. 600
12.00-14.00					max. 700
					max. 700
12.50-14.50					max. 760
					max. 760
16.00-18.00				280	450-600
				260	450-600
16.00-18.00			Ti:0.30-0.60	200	380-530
			N:0.015	200	380-530
16.00-18.00			4x(C+N)+0.15Ti0.80	240	420-600
				240	420-600
17.00-19.50		8.00-10.50	N:0.11	230	540-750
				210	520-720
18.00-20.00		10.00-12.00	N:0.11	220	520-670
				200	520-670
17.00-19.00		9.00-12.00	5xC‹Ti‹0.70	220	520-720
				200	520-720
17.00-19.00		9.00-12.00	10xC‹Nb‹1.00	220	520-720
				200	520-720
16.50-18.50	2.00-2.50	10.00-13.00		240	530-680
				220	530-680
16.50-18.50	2.00-2.50	10.00-13.00	N:0.11	240	530-680
				220	530-680
16.50-18.50	2.00-2.50	10.50-13.50	5xC‹Ti‹0.70	240	540-690
				220	540-690

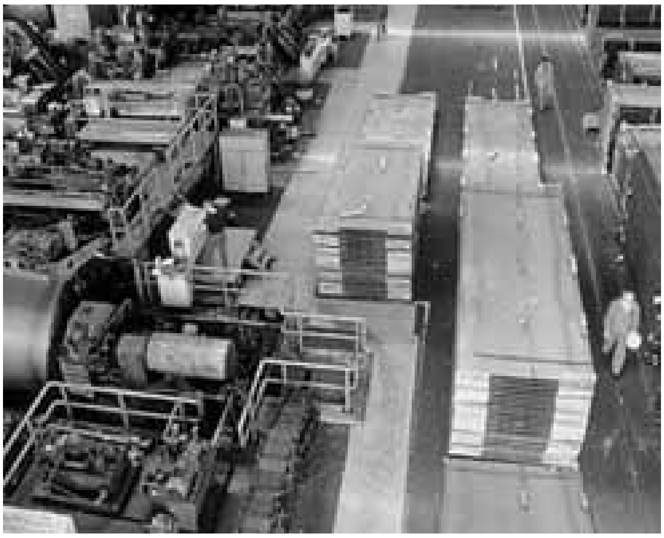
DIN EN 10 088-2

USA AISI	JAPAN JIS	GUS GOST	Werk-Stoff-Nr.	Kurzname	Delivery Condition	C % max.
316L	SUS316L	03Ch17N14M2	1.4435	X2CrNiMo18-14-3	K	0.02
					W	
S31726	SUS317		1.4439	X2CrNiMoN17-13-5	K	0.03
					W	
N08904			1.4539	X1NiCrMoCu25-20-5	K	0.03
					W	

USA AISI	JAPAN JIS	GUS GOST	Werk-Stoff-Nr.	Kurzname	C % max.	Si % max.
FERRITIC STEEL GRADES						
		15Ch6SJu	1.4713	X10CrAl7	0,12	0.5-1.0
		10Ch13SJu	1.4724	X10CrAl13	0,12	0.7-1.4
442			1.4742	X10CrAl18	0,12	0.7-1.4
446			1.4762	X10CrAl24	0,12	0.7-1.4
AUSTENTIC STEEL GRADES						
321H		12Ch18N10T	1.4878	X12CrNiTi18-9	0,12	1.0
309		20Ch20N14S2	1.4828	X15CrNiSi20-12	0,20	1.5-2-5
310S			1.4845	X12CrNi25-21	0,15	0.75
310		20Ch25N20S2	1.4841	X15CrNiSi25-20	0,20	1.5-2.5

*K = cold rolled; W = hot rolled





Al %	Cr %	Ni %	Sonstige %	0.2%- YS Rp0.2 N/mm_ min.	TS Rm N/mm_
0.5-1.0	6.0-8.0			220	420-620
0.7-1.2	12.0-14.0			250	450-650
0.7-1.2	17.0-19.0			270	500-700
1.2-1.7	23.0-26.0			280	520-720
	17.0-19.0	9.0-11.5	4xC‹Ti‹0.8	210	500-750
	19.0-21.0	11.0-13.0		230	500-750
	24.0-26.0	19.0-22.0		210	500-750
	24.0-26.0	19.0-22.0		230	550-800

Si % max.	Mn % max.	Cr %	Mo %	Ni %	Sonstige %	0.2%- YS Rp0.2 N/mm_min.	TS Rm N/mm_
0.50	2.00	17.00-18.50	2.00-2.50	11.50-13.50	Ti:0.40-0.60	190	490-690
						190	490-690
1.00	2.00	17.00-19.00	2.50-3.00	12.50-15.00	N:0,11	240	550-700
						220	550-700
1.00	2.00	16.50-18.50	4.00-5.00	12.50-14.50	N:0.12-0.22	290	580-780
						270	580-780





Extract of Nickel Alloy Plates

Norm	Grade	Chemical Composition								
		C max.	Si max.	Mn max.	P max.	S max.	Cr min-max	Ni min-max	Mo min-max	Ti
ASTM B 162	Alloy 200	0,15	0,35	0,35	-	0,01	-	99,0 min	-	-
UNS-Grade	N02200	0,15	0,35	0,35	-	0,01	-	99,0 min	-	-
ASTM B 127	Alloy 400	0,300	0,50	2,00	-	0,024	-	63,0 min	-	-
UNS-Grade	N04400	0,300	0,50	2,00	-	0,024	-	63,0 min	-	-
ASTM B 168	Alloy 600	0,150	0,50	1,00	-	0,015	14,0–17,0	72,0 min	-	-
UNS-Grade	N06600	0,150	0,50	1,00	-	0,015	14,0–17,0	72,0 min	-	-
ASTM B 409	Alloy 800	0,100	1,00	1,50	0,030	0,015	19,0–23,0	30,0–35,0	-	0,15-0,60
UNS-Grade	N08800	0,100	1,00	1,50	0,030	0,015	19,0-23,0	30,0-35,0	-	0,15-0,60
ASTM B 424	Alloy 825	0,050	0,50	1,00	-	0,030	19,5-23,5	38,0-46,0	2,5-3,5	0,60-1,20
UNS-Grade	N08825	0,050	0,50	1,00	-	0,030	19,5-23,5	38,0-46-0	2,5-3,5	0,6-1,2≥20xC
ASTM B 463	Alloy 8020	0,070	1,00	2,00	0,045	0,035	19,0-21,0	32,0-38,0	2,0-3,0	
UNS Grade	N08020	0,070	1,00	2,00	0,045	0,035	19,0-21,0	32,0-38,0	2,0-3,0	

Titanium Plates

ASTM Grade	Chemical Composition									
	N % max	C % max	H % max	Fe % max	O % max	Al % max	V % max	Pa	Mo	Ni
ASTM B 265 Grade 1	0,03	0,08	0,015	0,20	0,18	-	-	-	-	-
ASTM B 265 Grade 2	0,03	0,08	0,015	0,30	0,25	-	-	-	-	-
ASTM B 265 Grade 3	0,05	0,08	0,015	0,30	0,35	-	-	-	-	-
ASTM B 265 Grade 7	0,03	0,08	0,015	0,30	0,25	-	-	0,12-0,25	-	-
ASTM B 265 Grade 9	0,02	0,08	0,015	0,25	0,15	2,5-3,5	2,0-3,0	-	-	-
ASTM B 265 Grade 11	0,03	0,08	0,015	0,20	0,18	-	-	12,0-0,25	-	-
ASTM B 265 Grade 12	0,03	0,08	0,015	0,30	0,25	-	-	-	0,2-0,4	0,6-0,9

PLATE

Others min.	Rp 0,2 N/sq.mm	Rp 1,0 N/sq.mm	Rm N/sq.mm	A5 %	Heat treatment
	Mechanical properties and heat treatment				
Cu 0,25 max.	min. 100	-	min. 380	40	annealed
CU 0,25 max	min. 100	-	min. 380	40	annealed
Cu 28,0-34,0;Fe 2,5 max.	min. 195	-	min. 485	35	annealed
Cu 28,0-34,0;Fe 2,5 max.	min. 195	-	min. 485	35	annealed
Cu 0,5 max;Fe 6,0-10,0	min. 240	-	min. 550	30	annealed
Cu 0,5 max.;Fe 6,0-10,0	min. 240	-	min. 550	30	annealed
Cu 0,75 max.;Al 0,15-0,6;Fe 39,5 min	min. 205	-	min. 520	30	annealed
Cu 0,75 max.;Al 0,15-0,6;Fe 39,5 min.	min. 205	-	min. 520	30	annealed
Cu 1,5-3,0;Al 0,2 max.;Fe 22,0 min.	min. 241	-	min. 586	30	annealed
Cu 1,5-3,0;Al 0,2 max.;Fe Rest	min. 241	-	min. 586	30	annealed
Cu 3-4;Nb+Ta 8xC max. 1,0;Fe Rest	min. 241	-	min. 551	30	annealed
Cu 3-4;Nb+Ta 8xC max.1,0;Fe Rest	min. 241	-	min. 551	30	annealed

Remark: Mechanical properties are for hot rolled annealed execution.

Residuals/ Each	Residuals/ Total	Titanium	Rp 0,2 N/sq.mm	Rp 1,0 N/sq.mm min.	Rm N/sq.mm	A 5 % min.
			Mechanical properties and heat treatment			
0,1	0,4	Rem.	170 min.	-	240 min.	24
0,1	0,4	Rem.	275 min.	-	345 min.	20
0,1	0,4	Rem.	345 min.	-	450 min.	18
0,1	0,4	Rem.	275 min.	-	345 min.	20
0,1	0,4	Rem.	620 min.	-	483 min.	10
0,1	0,4	Rem.	170 min.	-	240 min.	24
0,1	0,4	Rem.	345 min.	-	483 min.	18

WERKSTOFF DIN EN	WERKSTOFF NR.	ISO	ASTM	BS	AFNOR	JIS
BLEIFREIES MESSING						
Cu Zn 5	2.0220	Cu Zn 5	C 21000	CZ 125	Cu Zn 5	C 2100
CW 500 L						
Cu Zn 10	2.0230	Cu Zn 10	C 22000	CZ 101	Cu Zn 10	C 2200
CW 501 L						
Cu Zn 15	2.0240	Cu Zn 15	C 23000	CZ 102	Cu Zn 15	C 2300
CW 502 L						
Cu Zn 20	2.0250	Cu Zn 20	C 24000	CZ 103	Cu Zn 20	C 2400
CW 503 L						
Cu Zn 28	2.0261					
CW 504 L						
Cu Zn 30	2.0265	Cu Zn 30	C 26000	CZ 105	Cu Zn 30	C 2600
CW 505 L						
Cu Zn 33	2.0280		C 26800		Cu Zn 33	C 2680
CW 506 L						
Cu Zn 36	2.0335		C 27000	CZ 107	Cu Zn 36	
CW 507 L						
Cu Zn 37	2.0321	Cu Zn 37	C 27400	CZ 108		C 2720
CW 508 L						
Cu Zn 40	2.0360	Cu Zn 40	C 28000	CZ 109	Cu Zn 40	C 2801
CW 509 L						
BLEIHALTIGES MESSING						
Cu Zn 39 Pb 0,5	2.0372		C 36500	CZ 123		C 3710
CW 610 N						
Cu Zn 39 Pb 2	2.0380		C 37700	CZ 120	Cu Zn 39 Pb 2	C 3713
CW 612 N						
SONDERMESSING						
Cu Zn 20 Al 2	2.0406	CuZn20 Al 2	C 68700	CZ 110	Cu Zn 22 Al 2	C 6870
CW 702 R						
Cu Zn 38 Sn 1	2.0530	CuZn38 Sn 1	C 46400	CZ 112	Cu Zn 38 Sn 1	C 4640
CW 717 R						
			C 46210	CZ 112		C 4621
Cu Zn 38 Sn Al	2.0525		C 47000			
CW 775 R						
KUPFER-NICKEL-KNETLEGIERUNGEN						
Cu Ni 10 Fe 1 Mn	2.0872	CuNi10Fe1Mn	C 70600	CN 102	Cu Ni 10 Fe	C 7060
CW 352 H						
Cu Ni 30 Mn 1 Fe	2.0882	CuNi30Mn1Fe	C 71500	CN 107	Cu Ni 30 Mn 1 Fe	C 7150
CW 354 H						
ALUMINIUMBRONZE						
Cu Al 5 As	2.0918	Cu Al 5	C 60800	CA 101	Cu Al 6	
CW 301 G						
Cu Al 8 Fe 3	2.0932	Cu Al 8 Fe 3	C 61400	CA 106	Cu Al 7 Fe 2	C 6140
CW 303 G						
Cu Al 9 Ni 3 Fe 2	2.0971	Cu Al 9 Ni3Fe2	C 62300	CA 103	Cu Al 9 Ni 3 Fe 2	C 6161
CW 304 G						
Cu Al 10 Fe 3 Mn 2	2.0936	Cu Al 10 Fe 3	C 62500	CA 105		C 6280
CW 306 G						
Cu Al 10 Ni 5 Fe 4	2.0966	CuAl10Ni5Fe4	C 63000	CA 104	Cu Al 9 Ni 5 Fe 3	C 6301
CW 307 G						
ZINNBRONZE						
Cu Sn 4	2.1016	Cu Sn 4	C 51800		Cu Sn 4 P	C 5111
CW 450 K						
Cu Sn 5		Cu Sn 5	C 51000	PB 102	Cu Sn 5 Zn 4	C 5102
CW 451 K						
Cu Sn 6	2.1020	Cu Sn 6	C 51900	PB 103	Cu Sn 6 P	C 5191
CW 452 K						
Cu Sn 8	2.1030	Cu Sn 8	C 521000	PB 104	Cu Sn 9 P	C 5212
CW 453 K						

COPPER ALLOY NO. C28000 (Muntz Metal, 60 %)

Composition-percent	Nominal	Minimum	Maximum
Copper	60	59.0	63.0
Lead	-	-	.30
Iron	-	-	.07
Zinc	40	Remainder	

Nearest Applicable ASTM Specifications	
Plate Products	-

Physical Properties	English Units	C. G. S. Units
Melting Point (Liquidus)	1660 F	905 C
Melting Point (Solidus)	1650 F	900 C
Density	.303 lb/cu in @ 68 F	8.39 gm/cu cm @ 20 C
Specific Gravity	8.39	8.39
Coefficient of Thermal Expansion	.0000116 per °F from 68 F to 572 F	.0000208 per °C from 20 C to 300 C
Thermal Conductivity	71 Btu/sq ft/ft/hr/°F @ 68 F	.29 cal/sq cm/cm/sec/°C @ 20 C
Electrical Resistivity (Annealed)	37.0 Ohms (circ mil/ft) @ 68 F	6.16 Microhm-cm @ 20 C
Electrical Conductivity * (Annealed)	28% IACS @ 68 F	.162 Megmho-cm @ 20 C
Thermal Capacity (Specific Heat)	.09 Btu/lb °F @ 68 F	.09 cal/gm/°C @ 20 C
Modulus of Elasticity (Tension)	15.000 ksi	10.500 Kg/sq mm
Modulus of Rigidity	5.600 ksi	3.900 Kg/sq mm

*Volume Basis

COPPER ALLOY NO. C36500 (Leaded Muntz Metal, Uninhibited)

Composition-percent	Nominal	Minimum	Maximum
Copper	59.5	58.0	61.0
Lead	.5	.25	.7
Iron	-	-	.15
Tin	-	-	.25
Zinc	40	Remainder	

Nearest Applicable ASTM Specifications	
Plate Products	B171

Physical Properties	English Units	C. G. S. Units
Melting Point (Liquidus)	1650 F	900 C
Melting Point (Solidus)	1630 F	885 C
Density	.304 lb/cu in @ 68 F	8.41 gm/cu cm @ 20 C
Specific Gravity	8.41	8.41
Coefficient of Thermal Expansion	.0000116 per °F from 68 F to 572 F	.0000208 per °C from 20 C to 300 C
Thermal Conductivity	71 Btu/sq ft/ft/hr/°F @ 68 F	.29 cal/sq cm/cm/sec/°C @ 20 C
Electrical Resistivity (Annealed)	37.0 Ohms (circ mil/ft) @ 68 F	6.16 Microhm-cm @ 20 C
Electrical Conductivity * (Annealed)	28% IACS @ 68 F	.162 Megmho-cm @ 20 C
Thermal Capacity (Specific Heat)	.09 Btu/lb °F @ 68 F	.09 cal/gm/°C @ 20 C
Modulus of Elasticity (Tension)	15.000 ksi	10.500 Kg/sq mm
Modulus of Rigidity	5.600 ksi	3.900 Kg/sq mm

COPPER ALLOY NO. C44300 (Admiralty, Arsenical)

Composition-percent	Nominal	Minimum	Maximum
Copper	71	70.0	73.0
Lead			.07
Iron			.06
Tin	1	.8	1.2
Arsenic		.02	.06
Zinc	28	Remainder	

Nearest Applicable ASTM Specifications	
Plate Products	B171

Physical Properties	English Units	C. G. S. Units
Melting Point (Liquidus)	1720 F	935 C
Melting Point (Solidus)	1650 F	900 C
Density	.308 lb/cu in @ 68 F	8.53 gm/cu cm @ 20 C
Specific Gravity	8.53	8.53
Coefficient of Thermal Expansion	.0000112 per °F from 68 F to 572 F	.0000202 per °C from 20 C to 300 C
Thermal Conductivity	64 Btu/sq ft/ft/hr/°F @ 68 F	.26 cal/sq cm/cm/sec/°C @ 20 C
Electrical Resistivity (Annealed)	41.5 Ohms (circ mil/ft) @ 68 F	6.90 Microhm-cm @ 20 C
Electrical Conductivity * (Annealed)	25% IACS @ 68 F	.145 Megmho-cm @ 20 C
Thermal Capacity (Specific Heat)	.09 Btu/lb °F @ 68 F	.09 cal/gm/°C @ 20 C
Modulus of Elasticity (Tension)	16.000 ksi	11.200 Kg/sq mm
Modulus of Rigidity	6.000 ksi	4.200 Kg/sq mm

COPPER ALLOY NO. C46400 (Naval Brass, Uninhibited)
COPPER ALLOY NO. C46500 (Naval Brass, Arsenical)

Composition-percent	Nominal	Minimum	Maximum
C46400			
Copper	60	59.0	62.0
Lead			.20
Iron			.10
Tin	.8	.50	1.0
Zinc	39.2	Remainder	
C46500-Same as C46400 with:			
Arsenic		.02	.06

Nearest Applicable ASTM Specifications	
Plate Products	B171

Physical Properties	English Units	C. G. S. Units
Melting Point (Liquidus)	1650 F	900 C
Melting Point (Solidus)	1630 F	885 C
Density	.304 lb/cu in @ 68 F	8.41 gm/cu cm @ 20 C
Specific Gravity	8.41	8.41
Coefficient of Thermal Expansion	.0000118 per °F from 68 F to 572 F	.0000212 per °C from 20 C to 300 C
Thermal Conductivity	67 Btu/sq ft/ft/hr/°F @ 68 F	.28 cal/sq cm/cm/sec/°C @ 20 C
Electrical Resistivity (Annealed)	39.9 Ohms (circ mil/ft) @ 68 F	6.63 Microhm-cm @ 20 C
Electrical Conductivity * (Annealed)	26% IACS @ 68 F	.151 Megmho-cm @ 20 C
Thermal Capacity (Specific Heat)	.09 Btu/lb °F @ 68 F	.09 cal/gm/°C @ 20 C
Modulus of Elasticity (Tension)	15.000 ksi	10.500 Kg/sq mm
Modulus of Rigidity	5.600 ksi	3.900 Kg/sq mm

COPPER ALLOY NO. C61400 (Aluminium Bronze, 7%)

Composition-percent		Nominal	Minimum
Copper (incl. Silver)	91		Remainder
Lead			.01
Iron	2	1.5	3.5
Zinc			.20
Aluminium	7	6.0	8.0
Manganese			1.0
Phosphorus			.015

Nearest Applicable Maximum ASTM Specifications	
Plate Products	B169, B171

Physical Properties	English Units	C. G. S. Units
Melting Point (Liquidus)	1915 F	1045 C
Melting Point (Solidus)	1905 F	1040 C
Density	.285 lb/cu in @ 68 F	7.89 gm/cu cm @ 20 C
Specific Gravity	7.89	7.89
Coefficient of Thermal Expansion	.0000090 per °F from 68 F to 572 F	.0000162 per °C from 20 C to 300 C
Thermal Conductivity	39 Btu/sq ft/ft/hr/°F @ 68 F	.16 cal/sq cm/cm/sec/°C @ 20 C
Electrical Resistivity (Annealed)	74.1 Ohms (circ mil/ft) @ 68 F	12.3 Microhm-cm @ 20 C
Electrical Conductivity * (Annealed)	14% IACS @ 68 F	.081 Megmho-cm @ 20 C
Thermal Capacity (Specific Heat)	.09 Btu/lb °F @ 68 F	.09 cal/gm/°C @ 20 C
Modulus of Elasticity (Tension)	17.000 ksi	12.000 Kg/sq mm
Modulus of Rigidity	6.400 ksi	4.500 Kg/sq mm

*Volume Basis

COPPER ALLOY NO. C63000 (Nickel Aluminium Bronze, 10%)

Composition-percent		Nominal	Minimum
Copper (incl. Silver)	82		
Iron	3	2.0	4.0
Tin			.20
Zinc			.30
Aluminium	10	9.0	11.0
Manganese			1.5
Silicon			.25
Nickel (incl. Cobalt)	5	4.0	5.5

Nearest Applicable Maximum ASTM Specifications	
Plate Products	B171

Physical Properties	English Units	C. G. S. Units
Melting Point (Liquidus)	1930 F	1054 C
Melting Point (Solidus)	1895 F	1035 C
Density	.274 lb/cu in @ 68 F	7.58 gm/cu cm @ 20 C
Specific Gravity	7.58	7.58
Coefficient of Thermal Expansion	.0000090 per °F from 68 F to 572 F	.0000162 per °C from 20 C to 300 C
Thermal Conductivity	22.6 Btu/sq ft/ft/hr/°F @ 68 F	.09 cal/sq cm/cm/sec/°C @ 20 C
Electrical Resistivity (Annealed)	116 Ohms (circ mil/ft) @ 68 F	19.2 Microhm-cm @ 20 C
Electrical Conductivity * (Annealed)	7% IACS @ 68 F	.041 Megmho-cm @ 20 C
Thermal Capacity (Specific Heat)	.09 Btu/lb °F @ 68 F	.09 cal/gm/°C @ 20 C
Modulus of Elasticity (Tension)	17.500 ksi	12.250 Kg/sq mm
Modulus of Rigidity	6.400 ksi	4.500 Kg/sq mm

COPPER ALLOY NO. C70600 (Copper Nickel, 10%)

Composition-percent	Nominal	Minimum	Maximum
Copper (incl. Silver)	88.6		Remainder
Lead			.05*
Iron	1.4	1.0	1.8
Zinc			1.0*
Nickel	10	9.0	11.0
Manganese			1.0

Nearest Applicable ASTM Specifications	
Plate Products	B122, B171

* When the product is for subsequent welding applications and so specified by the purchaser, Zn shall be .50% max., Pb .025% max., P .02% max., Sulfur .02% max. and Carbon .05% max.

Physical Properties	English Units	C. G. S. Units
Melting Point (Liquidus)	2100 F	1150 C
Melting Point (Solidus)	2010 F	1100 C
Density	.323 lb/cu in @ 68 F	8.94 gm/cu cm @ 20 C
Specific Gravity	8.94	8.94
Coefficient of Thermal Expansion	.0000095 per F from 68 F to 572 F	.0000171 per C from 20 C to 300 C
Thermal Conductivity	26 Btu/sq ft/ft/hr/ F @ 68 F	.11 cal/sq cm/cm/sec/ C @ 20 C
Electrical Resistivity (Annealed)	115 Ohms (circ mil/ft) @ 68 F	19.1 Microhm-cm @ 20 C
Electrical Conductivity * (Annealed)	9.0% IACS @ 68 F	.0522 Megmho-cm @ 20 C
Thermal Capacity (Specific Heat)	.09 Btu/lb F @ 68 F	.09 cal/gm/ C @ 20 C
Modulus of Elasticity (Tension)	18.000 ksi	12.700 Kg/sq mm
Modulus of Rigidity	6.800 ksi	4.800 Kg/sq mm

COPPER ALLOY NO. C71500 (Copper Nickel, 30%)

Composition-percent	Nominal	Minimum	Maximum
Copper	69.5	Remainder	
Lead			.05*
Iron	.5	.40	1.0
Zinc			1.0*
Nickel	30	29.0	33.0
Manganese			1.0

Nearest Applicable ASTM Specifications	
Plate Products	B122, B171

When the product is for subsequent welding applications and so specified by the purchaser, Zn shall be .50% max., Pb .025% max., P .02% max., Sulfur .02% max. and Carbon .05% max.

Physical Properties	English Units	C. G. S. Units
Melting Point (Liquidus)	2260 F	1240 C
Melting Point (Solidus)	2140 F	1170 C
Density	.323 lb/cu in @ 68 F	8.94 gm/cu cm @ 20 C
Specific Gravity	8.94	8.94
Coefficient of Thermal Expansion	.0000090 per °F from 68 F to 572 F	.0000162 per °C from 20 C to 300 C
Thermal Conductivity	17 Btu/sq ft/ft/hr/ °F @ 68 F	.07 cal/sq cm/cm/sec/ °C @ 20 C
Electrical Resistivity (Annealed)	225 Ohms (circ mil/ft) @ 68 F	37.5 Microhm-cm @ 20 C
Electrical Conductivity * (Annealed)	4.6% IACS @ 68 F	.0267 Megmho-cm @ 20 C
Thermal Capacity (Specific Heat)	.09 Btu/lb °F @ 68 F	.09 cal/gm/ °C @ 20 C
Modulus of Elasticity (Tension)	22.000 ksi	15.500 Kg/sq mm
Modulus of Rigidity	8.300 ksi	5.800 Kg/sq mm

Pressure Vessel Plates – Alloy Steel

Chemical Composition (%)								Tension Test			
Chemical Composition								Tensile Properties Class 2 plates / A 387			
Classific.	C	Mn	P	S	Si	Cr	Mo	Tensile strength KSI	Yield strength KSI min.	Elongation min % GL=8″	GL=2″
A387 Gr. 12	0.05-0.17	0.05-0.17	0.035 max.	0.040 max.	0.15-0.40	0.80-1.15	0.45-0.60	65-85 (450-585)	40 (275)	19	22
A387 Gr. 11	0.05-0.17	0.40-0.65	0.035 max.	0.040 max.	0.50-0.80	1.00-1.50	0.45-0.65	75-100 (515-690)	45 (310)	18	22
A387 Gr. 22	0.05-0.15	0.40-0.65	0.035 max.	0.035 max.	0.50 max.	2.00-2.50	0.90-1.10	75-100 (515-690)	45 (310)	--	1
A387 Gr. 5	0.15 max.	0.30-0.60	0.040 max.	0.030 max.	0.50 max.	4.00-6.00	0.45-0.65	75-100 (515-690)	45 (310)	--	18
A387 Gr. 9	0.15 max.	0.30-0.60	0.030 max.	0.030 max.	1.00 max.	8.00-10.00	0.90-1.10	75-100 (515-690)	45 (310)	--	18
	C	Mn	P	S	Si	Ni					
A203 Gr. D	0.17 max.	0.70 max.	0.035 max.	0.040 max.	0.15-0.40	3.25-3.75		65-85 (450-585)	37 (255)	19	23
A203 Gr. E	0.20 max.	0.70 max.	0.035 max.	0.040 max.	0.15-0.40	3.25-3.75		70-90 (485-620)	40 (275)	17	21
	C	Mn	P	S	Si	Mo					
A204 Gr. A	0.18 max.	0.90 max.	0.035 max.	0.040 max.	0.15-0.40	0.45-0.60		65-85 (450-585)	37 (255)	19	23
A204 Gr. B	0.20 max.	0.90 max.	0.035 max.	0.040 max.	0.15-0.40	0.45-0.60		70-90 (485-620)	40 (275)	17	21
A204 Gr. C	0.23 max.	0.90 max.	0.035 max.	0.040 max.	0.15-0.40	0.45-0.60		75-95 (515-655)	43 (295)	16	20





ASTM A 283-93 Low and Medium Strength Carbon Steel

Chemical Composition (%)								Tension Test			
Code	Maximum Available Thickness (mm)	Thickness (mm)	C	Mn	Si	P	S	Min. Yield Point ksi(Mpa)	Tensile Strength ksi(Mpa)	Min. Elongation (%) GL=200mm	GL=50mm
		‹1 1/2(40)			0.40 max			24	45-60	27	30
A 283-A	100		0.14 max	0.90 max.		0.035 max.	0.04 max.				
		1 1/2(40)‹t			0.15-0.40			(165)	(310-415)		
		‹1 1/2(40)			0.40 max			27	50-65	25	28
A 283-B	100		0.17 max	0.90 max.		0.035 max.	0.04 max.				
		1 1/2(40)‹t			0.15-0.40			(185)	(345-450)		
		‹1 1/2(40)			0.40 max			33	60-80	20	23
A 283-C	100		0.24 max	0.90 max.		0.035 max.	0.04 max.				
		1 1/2(40)‹t			0.15-0.40			(230)	(415-550)		
		‹1 1/2(40)			0.40 max			33	60-80	20	23
A 283-D	100		0.27 max	0.90 max.		0.035 max.	0.04 max.				
		1 1/2(40)‹t			0.15-0.40			(230)	(415-550)		

ASTM A 285/A 285M-90 Carbon Steel for Pressure Vessels for Low and Intermediate Tensile Strength

Chemical Composition (%)						Tension Test			
Classification	C	Mn	P	S	Cu (May be specified)	Tensile Strength ksi(Mpa)	Minimum Yield Pont ksi(Mpa)	Elongation (Min.)(%) GL=8 (200mm)	GL=2 (50 mm)
A 285A	0.17 max.	0.90 max.	0.035 max.	0.035 max.	0.20-0.35	45-65(310-450)	24(165)	27	30
A 285B	0.22 max.	0.90 max.	0.035 max.	0.035 max.	0.20-0.35	50-70(345-485)	27(185)	25	28
A 285C	0.28 max.	0.90 max.	0.035 max.	0.035 max.	0.20-0.35	55-75(380-515)	30(205)	23	27

ASTM A 516/A 516M-90 Carbon Steel for Moderate and Lower Temperature

Chemical Composition (%)									Tension Test			
	C Thickness in. (mm)						Mn Thickness in (mm)					
Classification	1/2″	1/2″‹t£2″(50)	2″‹t£4″(100)	4″‹t£8″(200)	8″(200)	Si	1/2″(13)and under	over 1/2″	Tensile Strength ksi(Mpa)	Minimum Yield Point ksi(Mpa)	Elongation(Min.)(%) GL=8 (200mm)	GL=2 (50mm)
A 515-55	0.18 max.	0.20 max.	0.22 max.	0.24 max.	0.26 max.	0.15-0.40	0.60-0.90	0.60-1.20	55-75 (380-515)	30(205)	23	27
A 515-60	0.21 max.	0.23 max.	0.25 max.	0.27 max.	0.27 max.	0.15-0.41	0.60-0.90	0.85-1.20	60-80 (415-550)	32(220)	21	25
A 515-65	0.24 max.	0.26 max.	0.28 max.	0.29 max.	0.29 max.	0.15-0.40	0.85-1.20	0.85-1.20	65-85 (450-585)	35(240)	19	23
A 515-70	0.27 max.	0.28 max.	0.30 max.	0.31 max.	0.31 max.	0.15-0.40	0.85-1.20	0.85-1.20	70-90 (485-620)	38(260)	17	21

Carbon and alloy steel plates comparison of standards

USA ASTM	Germany DIN	Europe EN
A 285 Gr. C.	H II	P 265 GH
A 516 Gr. 70	19 MN 5	P310 GH
A 204 Gr. A/B	15 Mo 3	16 Mo3
A 387 Gr. 12	13 CrMo 44	13 CrMo 45
A 387 Gr. 11	13 CrMo 44	13 CrMo 45
A387 Gr. 22	10 CrMo 910	---
A 387 Gr. 5	12 CrMo 195	---
A 387 Gr.9	X 11 CrMo 9-1	---
A 203 Gr. D	10 Ni 14	12 Ni 14
A 203 Gr. E	10 Ni 14	12 Ni 14



Extract of Nickel Alloy Bars

Norm	Grade	Chemical Composition								
		C max.	Si max.	Mn max.	P max.	S max.	Cr min-max.	Ni min-max.	Mo min-max.	Ti
ASTM B 160	Alloy 200	0,15	0,35	0,35	-	0,01	-	99,0 min.	-	-
UNS Grade	N02200	0,15	0,35	0,35	-	0,014	-	99,0 min.	-	-
ASTM B 164	Alloy 400	0,300	0,50	2,00	-	0,024	-	63,0 min.	-	-
UNS-Grade	N 04400	0,300	0,50	2,00	-	0,024	-	63,0 min.	-	-
ASTM B 166	Alloy 600	0,150	0,50	1,00	-	0,015	14,0 – 17,0	72,0 min.	-	-
UNS-Grade	N 06600	0,150	0,50	1,00	-	0,015	14,0 – 17,0	72,0 min.	-	-
ASTM B 408	Alloy 800	0,100	1,00	1,50	0,030	0,015	19,0 – 23,0	30,0 – 35,0	-	0,15 – 0,60
UNS-Grade	N 08800	0,100	1,00	1,50	0,030	0,015	19,0 – 23,0	30,0 – 35,0	-	0,15 – 0,60
ASTM B 425	Alloy 825	0,050	0,50	1,00	-	0,030	19,5 – 23,5	38,0 – 46,0	2,5 – 3,5	0,60 – 1,20
UNS-Grade	N 08825	0,050	0,50	1,00	-	0,030	19,5 – 23,5	38,0 – 46,0	2,5 – 3,5	0,6-1,2 ≥ 20xC
ASTM B 472	Alloy 8020	0,070	1,00	2,00	0,045	0,035	19,0 – 21,0	32,0 – 38,0	2,0 – 3,0	
UNS-Grade	N 08020	0,070	1,00	2,00	0,045	0,035	19,0 – 21,0	32,0 – 38,0	2,0 – 3,0	

Titanium Bars

ASTM Grade	Chemical Composition									
	N % max	C % max	H % max	Fe % max	O % max	Al % max	V % max	Pa	Mo	Ni
ASTM B 348 Grade 1	0,03	0,08	0,015	0,20	0,18	-	-	-	-	-
ASTM B 348 Grade 2	0,03	0,08	0,015	0,30	0,25	-	-	-	-	-
ASTM B 348 Grade 3	0,05	0,08	0,015	0,30	0,35	-	-	-	-	-
ASTM B 348 Grade 7	0,03	0,08	0,015	0,30	0,25	-	-	0,12 – 0,25	-	-
ASTM B 348 Grade 9	0,02	0,08	0,015	0,25	0,15	2,5 – 3,5	2,0 – 3,0	-	-	-
ASTM B 348 Grade 11	0,03	0,08	0,015	0,20	0,18	-	-	0,12 – 0,25	-	-
ASTM B 348 Grade 12	0,03	0,08	0,015	0,30	0,25	-	-	-	0,2 – 0,4	0,6 – 0,9

Others	Mechanical Properties and heat treatment				
	Rp 0.2/Nsqmm	Rp 1.0 N/sq.mm	Rm N/sq.mm	A5%	Heat treatment
Cu 0.25 max	min 105	-	min 415	35	annealed
Cu 0.25 max.	min 105	-	min 415	35	annealed
Cu 28.0-34.0; Fe 2.5 max.	min 170	-	min 480	35	annealed
Cu 28.0-34.0; Fe 2.5 max.	min 170	-	min 480	35	annealed
Cu 0.5 max.; Fe 6.0-10.0	min 240	-	min 585	30	annealed
Cu 0.5 max.; Fe 6.0-10.0	min 240	-	min 585	30	annealed
Cu 0.75 max.; Al 0.15-0.6; Fe 39.5 min	min 205	-	min 515	30	annealed
Cu 0.75 max.; Al 0.15-0.6; Fe 39.5 min	min 205	-	min 515	30	annealed
Cu 1.5-3.0; Al 0.2 max.; Fe 22.0 min.	min 241	-	min 586	30	annealed
Cu 1.5-3.0; Al 0.2 max.; Fe Rest	min 241	-	min 586	30	annealed
Cu 3-4; Nb + Ta 8xC max. 1.0; Fe Rest	min 241	-	min 551	30	annealed
Cu 3-4; Nb + Ta 8xC max. 1.0; Fe Rest	min 241	-	min 551	30	annealed

Remark: Mechanical Properties are for hot worked annealed execution

Residuals Each	Residuals Total	Titanium	Mechanical Properties Rp 0.2 N/sq.mm	Rp 1.0 N/sq.mm min.	Rm N/sq.mm	A5% min
0.1	0.4	Rem.	170 min	-	240 min	24
0.1	0.4	Rem.	275 min	-	345 min	20
0.1	0.4	Rem.	345 min	-	450 min	18
0.1	0.4	Rem.	275 min	-	345 min	20
0.1	0.4	Rem.	60 min	-	483 min	10
0.1	0.4	Rem.	170 min	-	240 min	24
0.1	0.4	Rem.	345 min	-	483 min	18

CARBON & ALLOY STEEL BAR

Intermediate & High Temperature Grades							Low-Temp Grades		
Round Bar ASTM Destination	A-182	A-182 A-739		A-182		A-105	A-350		
Round Bar Grade	F-1	F-12 B-11	F-11 B-22	F-22	F-5	N.A.	LF-1	LF-2	LF-3
Plate ASTM Designation	A-204 C-Mo	A-387 CR-Mo				A-515 A-516	A-516	A-516 A-537	A-203
Plate Grade	GRB&C	GR12	GR 11	GR 22	GR 5	ALL GRADES	ALL GRADES	ALL GRADES	GR D&F
Elements	Max % Composition Unless Otherwise Noted								
Carbon	.28	.10-.20	.10-.20	.05-.15	.15	.35	.30	.30	.20
Manganese	.60-.90	.30-.80	.30-.80	.30-.60	.30-.60	.60-1.05	1.35	1.35	.90
Phosphorus	.045	.040	.040	.040	.030	.040	.035	.035	.035
Sulfur	.045	.040	.040	.040	.030	.050	.040	.040	.040
Silicon	.15-.35	.10-.60	.50-1.00	.50	.50	.35	.15-.30	.15-.30	.20-.35
Chromium	-	.80-1.25	1.0-1.5	2.0-2.5	4.0-6.0	.30	.30	.30	.30
Molybdenum	.44-.65	.44-.65	.44-.65	.87-1.13	.44-.65	.12	.12	.12	.12
Nickel	-	-	-	-	.50	.40	.40	.40	3.25-3.75
Columbium	-	-	-	-	-	.02	.02	.02	.02
Vanadium	-	-	-	-	-	.03	.03	.03	.03
Copper	-	-	-	-	-	.40	.40	.40	.40
	Mechanical (Physical) Properties								
Tensile ksi	70	70	70	75	70	70	60-85	70-95	70-95
Yield ksi	40	40	40	45	40	36	30	36	37.5
Elongation % min.	20.0	20.0	20.0	20.0	20.0	30	28	30	30
Reduction of area % min.	30.0	30.0	30.0	30.0	35.0	30	38	30	35
Brinell Hardness	143-192	143-207	143.207	156-207	143-217	187	-	-	-



Carbon and alloy steel bars comparison of standards

USA ASTM	Germany DIN	Europe EN
A 105	C. 22.8	---
---	15 Mo 3	16 Mo 3
A 182 F 12	13 CrMo 44	13 CrMo 45
A 182 F 11	10 CrMo 44	13 CrMo 45
A 182 F 22	10 CrMo 910	---
A 182 F 5	12 CrMo 195	---
A 182 F 9	X 11 CrMo 9-1	---
A 350 LF 2	ST 52-3	S 355 J2 G3
A 350 LF 3	10 Ni 14	12 Ni 14



ADMIRALTY BRASS BARS

Chemical Composition
(%max., unless shown as range or min.)

	Cu	As	Fe	Pb	Sn(1)	Zn
Min./Max.	70.0-73.0	.02-.06	.06	.07	.8-1.2	Rem.
Nominal	71.0	.04	-	-	1.0	28.0

(1) For tubular products, the minimum Sn content may be .9%
Note: Cu + Sum of Named Elements, 99.6% min.

Applicable Specifications

Product	Specification
Plate, Clad	ASTM B432
Plate, Condenser Tube	ASME SB171
	ASTM B171
Tube	ASTM B135
Tube Condenser	ASME SB111
	ASTM B111
Tube, Finned	ASME SB359
	ASTM B359
Tube, U-Bend	ASME SB395
	ASTM B395
Tube, Welded	ASME SB543
	ASTM B543

NAVAL BRASS "LEAD FREE"

Chemical Composition
(%max., unless shown as range or min.)

	Cu	Fe	Pb	Sn	Zn
Min./Max.	59.0-62.0	.10	.20	.50-1.0	Rem.
Nominal	60.0	-	-	.7	39.2

Note: Cu + Sum of Named Elements, 99,6% min.

Applicable Specifications

Product	Specification
Bar	AMS 4611, 4612
	ASTM B21
	FEDERAL QQ-B-639
	SAE J461, J463
Bar, Forging	ASTM B124
Bolts	ASTM F468
Forgings, Die	ASTM B283
Nuts	ASTM F467
Plate	FEDERAL QQ-B-639
Plate, Clad	ASTM B432
Plate, Condenser Tube	ASME SB171
	ASTM B171
Rod	AMS 4611, 4612
	ASTM B21
	SAE J461, J463
Rod, Forging	ASTM B124

ALUMINIUM BRASS "ARSENICAL" C-687

Chemical Composition
(%max., unless shown as range or min.)

	Cu(1)	Al	As	Fe	Pb	Zn
Min./Max.	76.0-79.0	1.8-2.5	.02-.06	.06	.07	Rem.
Nominal	77.5	2.0	.04	-	-	20.5

(1) Cu value includes Ag.
Note: Cu + Sum of Named Elements, 99.5% min.

Applicable Specifications

Product	Specification
Tube, Condenser	ASME SB111
	ASTM B111
Tube, Finned	ASME SB359
	ASTM B359
Tube, U-Bend	ASME SB395
	ASTM B395
Tube, Welded	ASME SB543
	ASTM B543



NICKEL ALUMINIUM BRONZE C-630 BARS

Chemical Composition
(%max., unless shown as range or min.)

	Cu (1)	Al	Fe	Mn	Ni(2)	Si	Sn	Zn
Min./Max.	Rem.	9.0-11.0	2.0-4.0	1.5	4.0-5.5	.25	.20	.30
Nominal	82.0	10.0	3.0	-	5.0	-	-	-

(1) Cu value includes Ag.
(2) Ni value includes Co.
Note: Cu + Sum of Named Elements, 99.5% min.

Applicable Specifications

Product	Specification
Bar	AMS 4640
	ASME SB150
	ASTM B150
	FEDERAL QQ-C-450
	SAE J461, J463
Bar, Forging	ASTM B124
Bolts	ASTM F468
Forgings, Die	AMS 4640
	ASTM B283
	MILITARY MIL-B-16166
Nuts	ASTM F467
Plate	ASTM B171
	FEDERAL QQ-C-450
Plate, Condenser Tube	ASME SB171
	ASTM B171
Rod	AMS 4640
	ASME SB150
	ASTM B150
	SAE J461, J463
Rod, Forging	ASTM B124
Screws	ASTM F468
Shapes	AMS 4640
	ASTM B150
	SAE J461, J463
Shapes, Forging	ASTM B124
Sheet	FEDERAL QQ-C-450
Strip	FEDERAL QQ-C-450
Tube	AMS 4640

ALUMINIUM BRONZE C-614

Chemical Composition
(%max., unless shown as range or min.)

	Cu(1)	Al	Fe	Pb	Mn	P	Zn
Min./Max.	Rem.	6.0-8.0	1.5-3.5	.01	1.0	.015	.20
Nominal	91.0	7.0	2.0	-	-	-	-

(1) Cu value includes Ag.
Note: Cu + Sum of Named Elements, 99.5% min.

Applicable Specifications

Product	Specification
Bar	ASME SB169
	ASTM B169
	FEDERAL QQ-C-450
	SAE J461, J463
Bolts	ASTM F468
Nuts	ASTM F467
Pipe	ASTM B315
Pipe, Welded	ASTM B608
Plate	ASME SB169
	ASTM B169, B171
	FEDERAL QQ-C-450
Plate, Bridge and Bearing	ASTM B100
Plate, Clad	ASTM B432
Plate, Condenser Tube	ASME SB171
	ASTM B171
Rod	ASME SB150
	ASTM B150
	SAE J461, J463
Screws	ASTM F468
Shapes	SAE J461, J463
Sheet	ASME SB169
	ASTM B169
	FEDERAL QQ-C-450
	SAE J461, J463
Strip	ASME SB169
	ASTM B169
	FEDERAL QQ-C-450
	SAE J461, J463
Studs	ASTM F468
Tube	ASTM B315
Tube, Condensor	ASTM B111

COPPER NICKEL "90/10" C-706 BARS

Chemical Composition
(%max., unless shown as range or min.)

	Cu (1)	Fe	Pb	Mn	Ni(2)	Zn
Min./Max.	Rem.	1.0-1.8	.05	1.0	9.0-11.0	1.0
Nominal	88.6	1.4	-	-	10.0	-

(1) Cu value includes Ag.
(2) Ni value includes Co.
Note: Cu + Sum of Named Elements, 99.5% min.

Applicable Specifications

Product	Specification
Bar	ASTM B122, B151
	MILITARY MIL-C-15726
Pipe, Seamless	ASME SB466
	ASTM B466
Pipe, Welded	ASME SB467
	ASTM B467, B608
Plate	ASTM B122
	MILITARY MIL-C-15726
Plate, Clad	ASTM B432
Plate, Condenser Tube	ASME SB171
	ASTM B171
	SAE J461, J463
Rod	ASTM B151
	MILITARY MIL-C-15726
Rod, Welding	AWS A5.15
Sheet	ASTM B122
	MILITARY MIL-C-15726
	SAE J461, J463
Strip	ASTM B122
	MILITARY MIL-C-15726
Tube, Condenser	ASME SB111
	ASTM B111, B552
	MILITARY MIL-T-15005
	SAE J461, J463
Tube, Finned	ASME SB359
	ASTM B359
	MILITARY MIL-T-22214

COPPER NICKEL "70/30" C-715

Chemical Composition
(%max., unless shown as range or min.)

	Cu(1)	Fe	Pb	Mn	Ni(2)	Zn
Min./Max.	Rem.	.40-1.0	.05	1.0	29.0-33.0	1.0
Nominal	69.5	.50	-	-	30.0	-

(1) Cu value includes Ag.
(2) Ni value includes Co.
Note: Cu + Sum of Named Elements, 99.5% min.

Applicable Specifications

Product	Specification
Bar	ASTM B122, B151
	MILITARY MIL-C-15726
	SAE J461, J463
Bolts	ASTM F468
Electrode, Welding	AWS A5.6
	MILITARY MIL-E-22200/4
Nuts	ASTM F467
Pipe, Seamless	ASME SB466
	ASTM B466
Pipe, Welded	ASTM B467, B608
Plate	ASTM B122
	MILITARY MIL-C-15726
	SAE J461, J463
Plate, Clad	ASTM B432
Plate, Condenser Tube	ASME SB171
	ASTM B171
	SAE J461, J463
Rod	ASTM B151
	MILITARY MIL-C-15726
Screws	ASTM F468
Sheet	ASTM B122
	MILITARY MIL-C-15726
	SAE J461, J463
Strip	ASTM B122
	MILITARY MIL-C-15726
	SAE J461, J463
Studs	ASTM F468
Tube, Condenser	ASME SB111
	ASTM B111, B552
	MILITARY MIL-T-15005
	SAE J461, J463
Tube, Finned	ASME SB359
	ASTM B359
	MILITARY MIL-T-22214
Tube, Seamless	ASME SB466
	ASTM B466
	MILITARY MIL-T-16420
Tube, U-bend	ASME SB395
	ASTM B395
Tube, Welded	ASME SB543
	ASTM B543
Wire	MILITARY MIL-C-15726

Weight table - Round, Square and Hexagon Steel

Based on Density 7,85 kg/dm3

mm	○	□	⬡	mm	○	□	⬡	mm	○	□	⬡	mm	○	□	⬡
3	0,056	0,070	0,061	23	3,26	4,15	3,60	50	15,4	19,6	17,0	130	104	133	115
3.5	0,076	0,100	0,083	24	3,55	4,52	3,91	53	17,3	22,1	19,1	135	112	143	124
4	0,099	0,126	0,109	25	3,85	4,91	4,25	55	18,7	23,8	20,6	140	121	154	133
4.5	0,125	0,159	0,138	26	4,17	5,31	4,60	58	20,7	26,4	22,9	145	130	165	143
5	0,154	0,196	0,170	27	4,50	5,72	4,96	60	22,2	28,3	24,5	150	139	177	153
5,5	0,187	0,237	0,206	28	4,83	6,15	5,33	63	24,5	31,2	27,0	160	158	201	174
6	0,222	0,283	0,245	29	5,19	6,61	5,72	65	26,0	33,2	28,7	170	178	227	197
7	0,302	0,385	0,333	30	5,55	7,07	6,12	68	28,5	36,3	31,4	180	200	254	220
8	0,395	0,502	0,435	31	5,92	7,54	6,54	70	30,2	38,5	33,3	190	223	283	245
9	0,499	0,636	0,551	32	6,31	8,04	6,96	73	32,9	41,8	36,3	200	247	314	272
10	0,617	0,785	0,680	33	6,71	8,55	7,41	75	34,7	44,2	38,3	210	272	346	300
11	0,746	0,950	0,823	34	7,13	9,07	7,86	78	37,5	47,8	41,4	220	298	380	329
12	0,888	1,13	0,980	35	7,55	9,62	8,33	80	39,5	50,2	43,5	230	326	415	360
13	1,04	1,33	1,15	36	7,99	10,2	8,81	83	42,5	54,4	46,9	240	355	452	392
14	1,21	1,54	1,33	37	8,44	10,7	9,31	85	44,5	56,7	49,1	250	385	491	425
15	1,39	1,77	1,53	38	8,90	11,3	9,82	90	49,9	63,6	55,1	260	417	531	460
16	1,58	2,01	1,74	39	9,38	11,9	10,3	95	55,6	70,8	61,4	270	450	572	496
17	1,78	2,27	1,96	40	9,87	12,6	10,9	100	61,7	78,5	68,0	280	483	615	533
18	2,00	2,54	2,20	41	10,4	13,2	11,4	105	68,0	86,6	75,0	290	519	660	572
19	2,23	2,83	2,45	42	10,9	13,9	12,0	110	74,6	95,0	82,2	300	555	707	612
20	2,47	3,14	2,72	45	12,5	15,9	13,8	115	81,5	104,0	89,9				
21	2,72	3,46	3,00	46	13,0	16,6	14,4	120	88,8	113,0	97,9				
22	2,98	3,80	3,29	48	14,2	18,1	15,7	125	96,3	123,0	106,0				





Weight table - Flat Rolled Steel

width in mm	thickness in mm																				
	2	3	4	5	6	8	9	10	12	14	15	16	18	20	25	30	35	40	45	50	60
4	0,06	0,09																			
5	0,08	0,12	0,16																		
6	0,09	0,14	0,19	0,24																	
8	0,13	0,19	0,25	0,32	0,38																
10	0,16	0,24	0,31	0,39	0,47	0,63	0,71														
12	0,19	0,28	0,38	0,47	0,57	0,75	0,85	0,94													
14	0,22	0,33	0,44	0,55	0,66	0,88	0,99	1,10	1,32												
15	0,24	0,35	0,47	0,59	0,71	0,94	1,06	1,18	1,41	1,65											
16	0,25	0,38	0,50	0,63	0,75	1,01	1,13	1,26	1,51	1,76	1,88										
18	0,28	0,42	0,57	0,71	0,85	1,13	1,27	1,41	1,70	1,98	2,12	2,26									
20	0,31	0,47	0,63	0,79	0,94	1,26	1,41	1,57	1,88	2,20	2,36	2,51	2,83								
22	0,34	0,52	0,69	0,86	1,04	1,38	1,55	1,73	2,07	2,42	2,59	2,76	3,11	3,45							
24	0,38	0,57	0,75	0,94	1,13	1,51	1,70	1,88	2,26	2,64	2,83	3,01	3,39	3,77							
25	0,39	0,59	0,79	0,98	1,18	1,57	1,77	1,96	2,36	2,75	2,94	3,14	3,53	3,93							
26	0,41	0,61	0,82	1,02	1,23	1,63	1,84	2,04	2,45	2,86	3,06	3,27	3,67	4,08							
28	0,44	0,66	0,88	1,10	1,32	1,76	1,98	2,20	2,64	3,08	3,30	3,52	3,96	4,40	5,50						
30	0,47	0,71	0,94	1,18	1,41	1,88	2,12	2,36	2,83	3,30	3,53	3,i7	4,24	4,71	5,89						
32	0,50	0,75	1,00	1,26	1,51	2,01	2,26	2,51	3,01	3,52	3,77	4,02	4,52	5,02	6,28	7,54					
35	0,55	0,82	1,10	1,37	1,65	2,20	2,47	2,75	3,30	3,85	4,12	4,40	4,95	5,50	6,87	8,24					
40	0,63	0,94	1,26	1,57	1,88	2,51	2,83	3,14	3,77	4,40	4,71	5,02	5,65	6,28	7,85	9,42	11,0				
45	0,71	1,06	1,41	1,77	2,12	2,83	3,18	3,53	4,24	4,95	5,30	5,65	6,36	7,07	8,83	10,6	12,4	14,2			
50	0,78	1,18	1,57	1,96	2,36	3,14	3,53	3,93	4,71	5,50	5,89	6,28	7,07	7,85	9,81	11,8	13,7	15,7	17,6		
55	0,86	1,30	1,73	2,16	2,59	3,45	3,89	4,32	5,18	6,05	6,48	6,91	7,77	8,64	10,8	13,0	15,1	17,3	19,4	21,6	
60	0,94	1,41	1,88	2,36	2,83	3,77	4,24	4,71	5,65	6,59	7,07	7,54	8,48	9,42	11,8	14,1	16,5	18,8	21,2	23,6	
65	1,02	1,53	2,04	2,55	3,06	4,08	4,59	5,10	6,12	7,14	7,65	8,16	9,18	10,2	12,8	15,3	17,9	20,4	22,9	25,5	
70	1,10	1,65	2,20	2,75	3,30	4,40	4,95	5,50	6,59	77,69	8,24	8,79	9,89	11,0	13,7	16,5	19,2	22,0	24,7	27,5	
75	1,18	1,77	2,36	2,94	3,53	4,71	5,30	5,89	7,07	8,24	8,83	9,42	10,6	11,8	14,7	17,7	20,6	23,6	26,5	29,4	
80	1,26	1,88	2,51	3,14	3,77	5,02	5,65	6,28	7,54	8,79	9,42	10,0	11,3	12,6	15,7	18,8	22,0	25,1	28,3	31,4	37,7
85	1,33	2,00	2,67	3,34	4,00	5,34	6,01	6,67	8,01	9,34	10,0	10,7	12,0	13,3	16,7	20,0	23,4	26,7	30,0	33,4	40,0
90	1,41	2,12	2,83	3,53	4,24	5,65	6,36	7,07	8,48	9,89	10,6	11,3	12,7	14,1	17,7	21,2	24,7	28,3	31,8	35,3	42,4
95	1,49	2,24	2,98	3,73	4,47	5,97	6,71	7,46	8,95	10,4	11,2	11,9	13,4	14,9	18,6	22,4	26,1	29,8	33,6	37,4	44,8
100	1,57	2,36	3,14	3,93	4,71	6,28	7,07	7,85	9,42	11,0	11,8	12,6	14,1	15,7	19,6	23,6	27,5	31,4	35,3	39,3	46,8
110	1,73	2,59	3,45	4,32	5,18	6,91	7,77	8,64	10,4	12,1	13,0	13,8	15,5	17,3	21,6	25,9	30,2	34,5	38,8	43,2	51,8
120	1,88	2,83	3,77	4,71	5,65	7,54	8,48	9,42	11,3	13,2	14,1	15,1	17,0	18,8	23,6	28,3	33,0	37,7	42,4	47,1	56,5
130	2,04	3,06	4,08	5,10	6,12	8,16	9,18	10,2	12,3	14,3	15,3	16,3	18,4	20,4	25,5	30,6	35,7	40,8	45,9	51,0	61,3
140	2,20	3,30	4,40	55,50	6,59	8,79	9,89	11,0	13,2	15,4	16,5	17,019,8	22,0	27,5	33,0	38,5	44,0	49,5	55,0	66,0	
150	2,36	3,53	4,71	5,89	7,07	9,42	10,6	11,8	14,1	16,5	17,7	18,8	21,2	23,6	29,4	35,3	41,2	47,1	53,0	58,9	70,7
160	2,51	3,77	5,02	6,28	7,51	10,1	11,3	12,6	15,1	17,6	18,8	20,1	22,6	25,1	31,4	37,7	44,0	50,2	56,5	62,8	75,4
180	2,83	4,24	5,65	7,07	8,48	11,3	12,7	14,1	17,0	19,8	21,2	22,6	25,4	28,3	35,3	42,4	49,5	56,5	63,6	70,7	84,8
200	3,14	4,71	6,28	7,85	9,42	12,6	14,1	15,7	18,8	22,0	23,6	25, 1	28,3	31,4	39,3	47,1	55,0	62,8	70,6	78,5	94,2
250	3,93	5,89	7,85	9,81	11,8	15,7	17,7	19,6	23,6	27,5	29,4	31,4	35,3	39,3	49,1	58,9	68,7	78,5	88,3	98,1	118,0
300	4,71	7,07	9,42	11,8	14,1	18,8	21,2	23,6	28,3	33,0	35,3	37,7	42,3	47,1	58,9	70,7	82,4	94,2	106,0	118,0	141,0

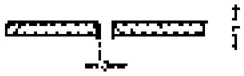
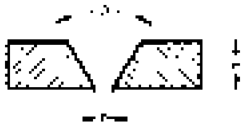
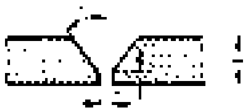
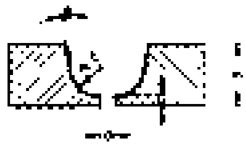
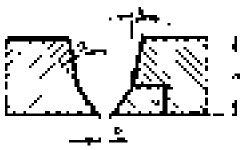
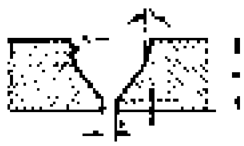
Steel Sheets and Plates

Standard Sizes, Thickness and approximate Weight per Piece

Thickness mm	2000mm x 1000mm	2500mm x 1250mm	3000mm x 1500mm	4000mm x 2000mm	5000mm x 2500mm	6000mm x 2000mm	6000mm x 2700mm	8000mm x 2000mm	8000mm x 2500mm	10000mm x 2500mm	12000mm x 3000mm
0,4	6	10									
0,5	8	13									
0,6	10	15									
0,7	11	18									
0,8	13	20									
0,9	14	23									
1,0	16	25									
1,2	19	30									
1,6	26	40	58								
2,0	32	50	72	128							
3,0	48	75	108	192	300	288		384	480	600	
4,0	64	100	144	256	400	384		512	640	800	
5,0	80	125	180	320	500	480		640	800	1000	
6,0	96	150	216	384	600	576		768	960	1200	
7,0	112	175	252	448	700	672		896	1120	1400	2016
8,0	128	200	288	512	800	768		1025	1280	1600	2304
9,0	144	225	324	576	900	864		1152	1440	1800	2592
10,0	160	250	360	540	1000	960		1280	1600	2000	2880
12,0	192	300	432	768	1200	1152	1555	1536	1920	2400	3456
12,5	200	330	450	800	1250	1200	1620	1600	2000	2500	3600
15,0	240	375	540	960	1500	1440	1944	1920	2400	3000	4320
20,0	320	500	720	1280	2000	1920	2592	2560	3200	4000	5760
25,0	400	625	900	1600	2500	2400	3240	3200	4000	5000	
30,0	480	750	1080	1920	3000	2880	3888	3840	4800		
35,0	560	875	1260	2240	3500	3660	4536	4480	5600		
40,0	640	1000	1440	2560	4000	3740	5184	5120			
45,0	720	1125	1620	2880	4500	4320					
50,0	800	1250	1800	3200	5000	4800					
55,0	880	1375	1980	3520							
60,0	960	1500	2160								
65,0	1040	1625	2340	4160							
70,0	1120	1750	2520	4480							
75,0	1200	1875	2700	4800							
80,0	1280	2000	2880	5120							
85,0	1360	2125	3060								
95,0	1520	2375	3420								
100,0	1600	2500	3600								
120,0	1920	6000	4320								
140,0	2240	3500	5040								
160,0	2560	4000									
180,0	2880	4500									
200,0	3220	5000									
220,0	3540	5500									

Weight Formula Plates:
Thickness (MM) x WIdth (METERS) x LENGTH (METERS) x 8 = Kg/Piece

Welding Ends
Welding End Preparation

Form	Designation	Sectional-view	Wall Thickness inch	Measures: Angle a	ß	Distance inch')	path inch
DIN 2559 F1	I-seam		≤3 ≤0.118	- -	- -	0 to 3 0 to 0.118	- -
DIN 2559 F2	V-seam		≤16 ≤0.630	≈ 60°	-	0 to 4 0 to 0.157	- -
ASA B 1 6,9 API Std SL/SLX -	- - - -		≤19 ≤0.750 ≤19 ≤0.750	≈37 1/2° 30°	- -	0 to 4 0 to 0.157 0 to 4 0 to 0.157	≈ 1,6 0.063 ≈1,6 ≈ 0.063
DIN 2559 F3	U-seam		≥12 ≥0.472	- -	≈10°	0 bis 3 0 to 0.118	2 0,079
DIN 2559 F4	U-seam on V-root		≥12 ≥0.472	30°	≈10°	0 bis 4 0 to O.157	≈4 ≈0.157
DIN 2559 F5	U-seam on V-root		≥16 ≥0.630	≈35°	≈6°	0 bis 2 0 to 0.079	≈6 ≈0.236
ASA- B 16,9	-		›19 ›0.750	≈37 1/2°	≈10°	0 to 2 0 to 0.079	≈1.6 ≈0.063

Conversion Tables - Linear/Square/Cubic measures and Weights

Linear measures

1 mm	= 0.039370 in.	1 inch	= 25,400 mm	
1 cm	= 0.393701 in.	1 inch	= 2,540 cm	
1 m	= 3.280840 ft.	1 foot	= 12 inches	= 0,3048 m
1 kg	= 0.6214 English mile	1 Yard	= 3 feet	= 914,4 mm
		1 English mile	= 1.60930km	

Square measures

1 mm2	= 0.001550 square inch	1 square inch	= 645,160 mm2	
1 cm 2	= 0.155000 square inch	1 square inch	= 6,541600 cm2	
1 m2	= 10.763911 square feet	1 square foot	= 144 square inches	= 0,092903 m2

Cubic measures

1 cm3	= 0.061024 cubic inch	1 cubic inch	= 16,387064 cm3	
1 dm3	= 0.035315 cubic inch	1 cubic foot	= 1728 cubic inches	= 28,316847 dm3
1 m3	= 35.314670 cubic feet	1 cubic foot	= 0,028317 m3	

Weights

1 g	= 0.035274 ounce	1 ounce	= 28,3495 g	
1 kg	= 2.204622 pounds (lb)	1 pound (lb)	= 16 ounces	= 0,453592 kg
1 metric ton	= 0.984206 long ton	1 long ton	= 2240 lb	= 1016,04706 kg
	= 1.10231 short ton	1 short ton	= 2000 lb	= 907,185 kg

Weights per linear, square or cubic unit measure

1 kg/cm	= 5.599741 lb./in.	1 lb./in.	= 0,178580 kg/cm	
1 kg/m	= 0.671969 lb./foot	1 lb./foot	= 1,488164 kg/m	
1 kp/mm2	= 1422.336968 lb./sq. in.	1 lb./sq. in.	= 0,000703 kg/mm2	
1 kp/cm2	= 14.223370 lb./sq. in.	1 lb./sq. in.	= 0,070307 kg/cm2	
1 kp/m2	= 0.204816 lb./sq. ft.	1 lb./sq. ft.	= 4,882430 kg/m2	
1 kp/cm	= 36.127135 lb./cu. in.	1 oz./sq. ft.	= 305,15 p/m2	
1 kp/m3	= 0.062428 lb./cu. ft	1 long ton/sq.in.	= 1,575 kp/mm2	
		1 lb./cu. in.	= 0,027680 kp/cm3	
		1 lb./cu. ft.	= 16,018464 kp/m3	

1 kp/mm2	= 9.80665 N/mm2	1 N/mm2	= 0,101972 kp/mm2	
1 kmp	= 9,80665 J	1 J	= 0,101972 kpm	
1 kpm	= 7,233 ft.-lbs.	1 ft.-lb.	= 0,138254 kpm	
1 J	= 0,7376 ft.-lbs.	1 ft.-lb.	= 1,355748 J	

Freight Cost Calculation for Tubes-"measuring sizes"

Qutside Diameter mm	inch (N.B.)	measuring incl. mm wall	m/m3	x measuring	measuring/m with 100 DM/m3
2.020		85,5	0,25	4,08	408,04
1.920		81,5	0,27	3,69	369,64
1.820		77,0	0,30	3,312	331,24
1.720		72,5	0,34	2,96	295,84
1.620	64	68,5	0,38	2,62	262,44
1.520		64,0	0,43	2,31	231,04
1.420		60,0	0,50	2,02	201,64
1.321	52	55,5	0,57	1,75	174,50
1.270	50	53,5	0,62	1,61	161,29
1.219	48	51,5	0,67	1,49	148,60
1.168	46	49,4	0,73	1,36	136,42
1.120	44	47,4	0,80	1,25	125,44
1.067	42	45,1	0,88	1,14	113,85
1.016	40	43,0	0,97	1,03	103,22
965	38	40,8	1,07	0,93	93,12
914	36	38,7	1,20	0,84	83,54
864	34	36,5	1,34	0,75	74,65
813	32	34,4	1,51	0,66	66,10
762	30	32,2	1,72	0,58	58,06
711	28	30,1	1,98	0,51	50,55
660	26	27,9	2,30	0,44	43,56
610	24	25,8	2,69	0,37	37,21
559	22	23,6	3,20	0,31	31,25
521		22,0	3,68	0,27	27,14
508	20	21,5	3,88	0,26	25,81
470		19,9	4,53	0,22	22,09
457,2	18	19,3	4,78	0,21	20,90
419		17,7	5,70	0,176	17,56
406,4	16	17,2	6,05	0,165	16,52
368		15,5	7,38	0,135	13,54
355,6	14	15,0	7,91	0,127	12,65
323,9	12	13,7	9,53	0,105	10,49
318		13,4	9,89	0,101	10,11
298,5		12,6	11,22	0,089	8,91
273	10	11,5	13,42	0,075	7,45
267		11,3	14,03	0,071	7,13
244,5		10,3	16,73	0,06	5,98
219,1	8	9,2	20,83	0,048	4,80
216		9,1	21,43	0,047	4,67
193,7		8,2	26,65	0,038	3,75
177,8		7,5	31,63	0,032	3,16
168,3	6	7,1	35,30	0,028	2,83
165,1		6,9	36,69	0,027	2,73
159		6,7	39,56	0,025	2,53
152,4		6,4	43,06	0,023	2,32
141,3	5	5,9	50,09	0,02	2,00
139,7		5,9	51,24	0,02	1,95
133		5,6	56,53	0,018	1,77
127		5,3	62,00	0,016	1,61
121		5,1	68,30	0,015	1,46
114,3	4	4,8	76,54	0,013	1,31
108		4,5	85,73	0,012	1,17
101,6	3 1/2	4,3	96,88	0,01	1,03
88,9	3	3,7	126,53	0,008	0,79
76,1		3,2	172,68	0,006	0,58
73,0	2 1/2	3,0	187,65	0,53	0,53
70,0		2,9	204,08	0,005	0,49
63,5		2,6	248,00	0,004	0,40
60,3	2	2,5	275,03	0,004	0,36
57,0		2,4	307,79	0,003	0,33
51,0		2,1	384,47	0,003	0,26

In the table of European standards for metallic materials, specifications for seamless and welded steel pipes and pipes products, wire and wire products, forgings, sheets, strips and definition of steel products are presented.

EN 1369	1996 - 09	Founding; magnetic particle inspection
EN 1370	1996 - 09	Founding; surface roughness inspection by visualtactile comparators
EN 1371-1	1994 - 02	Founding; liquid penetrant inspection; part 1: sand, gravity die and low pressure die castings
EN 1559-1	1994 - 08	Founding - Technical conditions of delivery - Part 1: General
EN 1559-2	1995 - 09	Founding - Technical conditions of delivery - Part 2: Additional requirements for steel castings
EN 1559-3	1994 - 08	Founding - Technical conditions of delivery - Part 3: Additional requirements for iron castings
EN 1559-5	1995 - 03	Founding - Technical conditions of delivery - Part 5: Additional requirements for magnesium alloy castings
EN 1560	1994 - 08	Founding - Designation system for cast iron - Material symbols and material numbers
EN 1561	1994 - 08	Founding - Grey cast irons EN 1562 1994 - 08Founding - Malleable cast irons
EN 1563	1994 - 08	Founding - Spheroidal graphite cast irons
EN 1564	1994 - 08	Founding - Austempered ductile cast irons
EN 12454	1996 - 12	Founding - Visual examination of surface disccontinuities - Steel and castings
EN 10001	1990 - 07	Definition and classification of pig - irons
EN 10016 - 1	1994 - 12	Non - alloy steel rod for drawing and/or cold rolling Part 1: General requirements
EN 10016 - 2	1994 - 12	Non - alloy steel rod for drawing and/or cold rolling Part 2: Specific requirements for general purposes rod
EN 10016 - 3	1994 - 12	Non - alloy steel rod for drawing and/or cold rolling Part 3: Specific requirements for rimmed and rimmed substitute low carbon steel rod
EN 10016 - 4	1994 12	Non - alloy steel rod for drawing and/or cold rolling Part 4: Specific requirements for rod for special applications
EN 10020	1995 - 12	Definition and classification of grades of steel
EN 10020 / AC	1996 - 08	Determination and classification of grades of steel; amendment to EN 10020: 1988
EN 10021	1996 - 01	General technical delivery requirements for steel and iron products
EN 10024	1996 - 08	Hot rolled taper flange I sections - Tolerances on shape and dimensions
EN 10025	1996 - 08	Hot rolled products of non -alloy structural steels; technical delivery conditions (includes amendment A1: 1993)
EN 10027 - 1	1995 - 12	Designation systems for steels; part 1: steel names, principal symbols
EN 10027 - 2	1995 - 12	Designation systems for steels; part 2: numerical system
ECISS/IC 10	1995 - 12	Designation systems for steel: Additional symbols for steel names
EN 10028 - 1	1996 - 08	Flat products made of steels for pressure purposes Part 1: general requirements
EN 10028 - 2	1996 - 08	Flat products made of steels for pressure purposes Part 2: non - alloy and alloy steels with specified elevated temperature properties
EN 10028 - 3	1992 - 12	Flat products made of steels for pressure purposes; part 3: weldable fine grain steels, normalized
EN 10028 - 4	1994 - 09	Flat products made of steels for pressure purposes Part 4: Nickel alloy steels with specified low temperature properties
EN 10028 - 5	1993 - 10	Flat products made of steels for pressure purposes Part 5: weldable fine grain steels, thermomechanically rolled
EN 10028 - 6	1993 - 10	Flat products made of steels for pressure purposes Part 6: weldable fine grain steels, quenched and tempered
EN 10029	1996 - 08	Hot rolled steel plates 3 mm thick or above; tolerances on dimensions, shape and mass
EN 10029/AC	1996 - 08	Hot rolled steel plates 3 mm thick or above; tolerances on dimensions, shape and mass
EN 10034	1993 - 09	Structural steel I and H sections; tolerances on shape and dimensions
EN 10048	1995 - 06	Hot rolled narrow steel strip - Tolerances on dimensions and shape
EN 10051	1991 - 12	Continuously hot - rolled uncoated plate, sheet and strip of non - alloy and alloy steels; tolerances on dimensions and shape
EN 10051/A1	1995 - 09	Continuously hot - rolled uncoated plate, sheet and strip of non - alloy and alloy steels; tolerances on dimensions and shape

EN 10052	1996 - 08	Vocabulary of heat treatment terms for ferrous products
EN 10055	1995 - 11	Hot rolled steel equal flange tees with radiused root and toes Dimensions and tolerances on shape and dimensions
EN 10056	1991 - 03	Structural steel equal and unequal leg angles; tolerances on shape and dimensions
EN 10056 - 1	1994 - 11	Structural steel equal and unequal leg angles - Part 1: Dimensions
EN 10056 - 2	1993 - 09	Structural steel equal and unequal leg angles; part 2: tolerances on shape and dimensions
EN 10067	1992 - 08	Hot rolled bulb flats; dimensions and tolerances on shape and dimensions
EN 10079	1995 - 12	Definition of steel products
ENV 10080	1995 - 04	Steel for the reinforcement of concrete - Weldable ribbed reinforcing steel B 500 Technical delivery conditions for bars, coils and welded fabric
EN 10083 - 1	1996 - 08	Quenched and tempered steels; part 1: technical delivery conditions for special steels
EN 10083 - 1/A1	1995 - 03	Quenched and tempered steels - Part 1: Technical delivery conditions for special steels
EN 10083 - 2	1991 - 02	Quenched and tempered steels - Part 2: Technical delivery conditions for unalloyed quality steels
EN 10083 - 2/A1	1995 - 03	Quenched and tempered steels - Part 2: Technical delivery conditions for unalloyed quality steels
EN 10083 - 3	1995 - 09	Quenched and tempered steels - Part 3: Technical delivery conditions for boron steels
EN 10084EN 10087	1995 - 021995 - 04	Case hardening steels - Technical delivery conditionsFree - cutting steels - Technical delivery conditions for semi - finished products, hot rolled bars and rods
EN 10088 - 1	1995 - 04	Stainless steels - Part 1: List of stainless steels
EN 10088 - 2	1995 - 04	Stainless steels - Part 2: Technical delivery conditions for sheet/plate and strip for general purposes
EN 10088 - 3	1995 - 04	Stainless steels - Part 3: Technical delivery conditions for semi finished products, bars, rods and sections for general purposes
EN 10095	1996 - 02	Heat - resisting steels and alloys
EN 10106	1995 - 12	Cold rolled non - oriented electrical steel sheet and strip delivered in fully processed state
EN 10107	1995 - 12	Grain - oriented electrical steel sheet and strip delivered in fully processed state
EN 10111	1993 - 06	Continuously hot-rolled low carbon steel sheet and strip for cold bending; technical delivery conditions
EN 10113 - 1	1993 - 03	Hot-rolled products in weldable fine grain structural steels Part 1: general delivery conditions
EN 10113 - 2	1993 - 03	Hot-rolled products in weldable fine grain structural steels Part 2: delivery conditions for normalized/normalized rolled steels
EN 10113 - 3	1993 - 03	Hot-rolled products in weldable fine grain structural steels Part 3: delivery conditions for thermomechanical rolled steels
EN 10120	1994 - 06	Steel sheet and strip for welded gas cylinders
EN 10126	1995 - 12	Cold rolled electrical non-alloyed steel sheet and strip delivered in semi-processed state
EN 10130	1991 - 03	Cold rolled low carbon steel flat products for cold forming; technical delivery conditions
EN 10130/A1	1995 - 03	Cold rolled low carbon steel flat products for cold forming; -Technical delivery conditions
EN 10137 - 2	1995 - 09	Plates and wide flats made of high yield strength structural steels in the quenched and tempered or precipitation hardened conditions - Part 2: Delivery conditions for quenched and tempered steels
EN 10131	1991 - 11	Cold rolled uncoated low carbon high yield strength steel flat products for cold forming; tolerances on dimensions and shape
EN 10137 - 1	1995 - 09	Plates and wide flats made of high yield strength structural steels in the quenched and tempered or precipitation hardened conditions - Part 1: General delivery conditions
EN 10137 - 2	1995 - 09	Plates and wide flats made of high yield strength structural steels in the quenched and tempered or precipitation hardened conditions - Part 2: Delivery conditions for quenched and tempered steels
EN 10137 - 3	1995 - 09	Plates and wide flats made of high yield strength structural steels in the quenched and tempered or precipitation hardened conditions - Part 3: Delivery conditions for precipitation hardened steels
EN 10138 - 1	1991 - 11	Prestressing steels; part 1: general requirements
EN 10138 - 2	1991 - 11	Prestressing steels; part 2: stress relieved cold drawn wire
EN 10138 - 3	1991 - 11	Prestressing steels; part 3: strand
EN 10138 - 4	1991 - 11	Prestressing steels; part 4: hot rolled and processed bars
EN 10138 - 5	1991 - 11	Prestressing steels; part 5: quenched and tempered wire
EN 10139	1992 - 10	Cold rolled uncoated mild steel narrow strip for cold forming; technical delivery conditions

EN 10140	1992 - 10	Cold rolled narrow steel strip; tolerances on dimensions and shape
EN 10142	1996 - 08	Continously hot-dip zinc coated low carbon steel sheet and strip for cold forming; technical delivery conditions
EN 10143	1993 - 01	Continously hot-dip metal coated steel sheet and strip; tolerances on dimensions and shape
EN 10147	1991 - 11	Continously hot-dip zinc coated unalloyed structural steel sheet and strip; technical delivery conditions
EN 10147/A1	1995 - 06	Continously hot-dip zinc coated structural steel strip and sheet - Technical delivery conditions; Amendment A1
EN 10149 - 1	1995 - 09	Hot rolled flat products made of high yield strength steels for cold forming Part 1: General delivery conditions
EN 10149 - 2	1995 - 09	Hot rolled flat products made of high yield strength steels for cold forming Part 2: Delivery conditions for thermomechanically rolled steels
EN 10149 - 3	1995 - 09	Hot rolled flat products made of high yield strength steels for cold forming Part 3: Delivery conditions for normalized or normalized rolled steels
EN 10152	1993 - 10	Electrolytically zinc coated cold rolled steel flat products; technical delivery conditions
EN 10154	1995 - 10	Continuously hot-dip aluminium-silicon (AS) coated steel strip and sheet - Technical delivery conditions
EN 10155	1993 - 06	Structural steels with improved atmospheric corrosion resistance; technical delivery conditions
EN 10163 - 1	1991 - 08	Delivery requirements for surface condition of hot rolled steel plates, wide flats and sections Part 1: general requirements
EN 10163 - 2	1991 - 08	Delivery requirements for surface condition of hot rolled steel plates, wide flats and sections Part 2: plate and wide flats
EN 10163 - 3	1991 - 08	Delivery requirements for surface condition of hot rolled steel plates, wide flats and sections Part 3: sections
EN 10163 - 4	1991 - 09	Delivery requirements for surface quality of hot rolled steel products; part 4: round bars and wire rod
EN 10164	1993 - 06	Steel products with improved deformation properties perpendicular of the product; technical delivery conditions
EN 10165	1995 - 12	Cold rolled electrical alloyed steel sheet and strip delivered in semi - processed state
EN 10169 - 1	1995 - 08	Continuously organic coated steel flat products Part 1: General information (definitions, materials, tolerances, test methods)
EN 10169 - 2	1995 - 10	Continuously organic coated (coil coated) steel flat products Part 2: Products for building exterior applications
EN 10173	1987 - 03	Double cold reduced electrolytic chromium/chromium oxide coated steel; coil for subsequent cutting into sheets
EN 10202	1996 - 08	Cold reduced electrolytic chromium/chromium oxide coated steel
EN 10203	1991 - 08	Cold reduced electrolytic tinplate
EN 10204	1996 - 01	Metallic products; types of inspection documents
EN 10204/A1	1996 - 01	Metallic products-Types of inspection documents; Amendment A1
EN 10205	1991 - 11	Cold reduced blackplate in coil form for the production of tinplate or electrolytic chromium/chromium oxide coated steel
EN 10207	1991 - 11	Steels for simple pressure vessels; technical delivery requirements for plates, strips and bars
EN 10208 - 1	1992 - 11	Steel pipes for pipe lines for combustible fluids; technical delivery conditions Part 1: pipes of requirement class A
EN 10208 - 2	1996 - 09	Steel pipes for pipe lines for combustible fluids; technical delivery conditions; Part 2: pipes of requirement class B
EN 10209	1996 - 10	Cold rolled low carbon steel flat products for vitreous enamelling - Technical delivery conditions
EN 10210 - 1	1994 - 03	Hot finished structural hollow sections of non - alloy and fine grain structural steels Part 1: technical delivery requirements
EN 10210 - 2	1992 - 09	Hot finished structural hollow sections of non - alloy and fine grain structural steels Part 2: tolerances, dimension and sectional properties
EN 10213 - 1	1995 - 12	Technical delivery conditions for steel castings for pressure purposes - Part 1: General
EN 10213 - 2	1995 - 12	Technical delivery conditions for steel castings for pressure purposes Part 2: Steel grades for use at room temperature and elevated temperatures
EN 10213 - 3	1995 - 12	Technical delivery conditions for steel castings for pressure purposes Part 3: Steel grades for use at low temperatures

EN 10213 - 4	1995 - 12	Technical delivery conditions for steel castings for pressure purposes Part 4: Austenitic and austenitic - ferritic steel grades
EN 10214	1995 - 02	Continuously hot-dip zinc-aluminium (ZA) coated steel strip and sheet - Technical delivery conditions
EN 10215	1995 - 02	Continuously hot-dip aluminium-zinc (AZ) coated steel strip and sheet - Technical delivery conditions
EN 10216-1	1995 - 11	Seamless steel tubes for pressure purposes; technical delivery conditions Part 1: non-alloy steel with specified room temperature properties
EN 10217 - 1	1991 - 02	Welded steel tubes for pressure purposes; technical delivery conditions Part 1: non -alloy steel with specified room temperature properties
EN 10218 - 1 EN 10218 - 2	1994 - 031995 - 11	Steel wire and wire products; general Part 1: test methodsSteel wire and wire products; general; part 2: wire dimensions and tolerances
EN 10219 - 1	1992 - 09	Cold formed structural hollow sections of non-alloy and fine grain structural steels Part 1: technical delivery requirements
EN 10219 - 2	1992 - 09	Cold formed structural hollow sections of non-alloy and fine grain structural steels Part 2: tolerances, dimensions and sectional properties
ENV 10220	1993 - 11	Seamless and welded steel tubes; dimensions and masses per unit length
EN 10221	1995 - 11	Surface quality classes for hot-rolled bars and rods - Technical delivery conditions
EN 10222 - 1	1994 - 06	Steel forgings for pressure purposes Part 1: General requirements for open die forgings
EN 10222 - 3	1994 - 06	Steel forgings for pressure purposes Part 3: Ferritic and martensitic steels with elevated temperature properties
EN 10222 - 4	1994 - 06	Steel forgings for pressure purposes Part 4: Nickel steels with specified low temperature properties
EN 10222 - 5	1994 - 06	Steel forgings for pressure purposes Part 5: Fine grain steels with high proof stress
EN 10222 - 6	1994 - 06	Steel forgings for pressure purposes Part 6: Austenitic, martensitic and austenitic-ferritic stainless steels
EN 10223 - 1	1993 - 02	Steel wire and wire products for fences Part 1: zinc and zinc-alloy coated steel barbed wire
EN 10223 - 2	1993 - 04	Steel wire and wire products for fences Part 2: hexagonal steel wire netting for agricultural, insulation, and fencing purposes
EN 10223 - 3	1993 - 04	Steel wire and wire products for fences Part 3: hexagonal steel wire netting for engineering purposes
EN 10223 - 4	1994 -10	Steel wire and wire products for fences Part 4: Steel wire welded mesh fencing
EN 10223 - 5	1994 -10	Steel wire and wire products for fences Part 5: Steel wire woven hinged joint and knotted joint stock fencing
EN 10223 - 6	1994 -10	Steel wire and wire products for fences Part 6: Steel wire chain link fencing
EN 10224	1995 - 05	Steel tubes and fittings for the conveyance of aqueous liquids including water for human consumption
EN 10225	1994 - 10	Weldable structural steels for fixed offshore structures
EN 10226 - 1	1995 -11	Pipe threads where pressure tight joints are made on the threads Part 1: Designation, dimensions and tolerances
EN 10229	1995 - 08	Evaluation of resistance of steel products to hydrogen induced cracking (HIC)
EN 10230	1993 - 02	Steel wire and wire products; common, special and loose feed stock steel wire machine nails
EN 10238	1995 - 12	Automatically blast cleaned and primed steel products
EN 10240	1994 - 06	Internal and/or external protective coatings for steel tubes - Specification for hot dip galvanized coatings
EN 10241	1994 - 06	Threaded steel fittings
EN 10242	1994 - 11	Threaded pipe fitting in malleable cast iron
EN 10243 - 1	1995 - 08	Steel drop and press forgings - Tolerances on dimensions
EN 10243 - 2	1995 - 08	Steel upset forgings made on horizontal forging machines -Tolerances on dimensions
EN 10244 - 1	1995 - 01	Steel wire and wire products - Non-ferrous metallic coatings on steel wire Part 1: General principles

EN 10244 - 2	1995 - 01	Steel wire and wire products - Non-ferrous metallic coatings on steel wire Part 2: Zinc or zinc alloy coatings on steel wire
EN 10244 - 3	1995 - 01	Steel wire and wire products - Non-ferrous metallic coatings on steel wire Part 3: Aluminium coatings
EN 10244 - 4	1995 - 01	Steel wire and wire products - Non-ferrous metallic coatings on steel wire Part 4: Tin coatings
EN 10244 - 5	1995 - 01	Steel wire and wire products - Non-ferrous metallic coatings on steel wire Part 5: Nickel coatings
EN 10244 - 6	1995 - 01	Steel wire and wire products - Non-ferrous metallic coatings on steel wire Part 6: Copper, bronze or brass coatings
EN 10245 - 1	1995 - 01	Steel wire and wire products - Organic coatings on wire -Part 1: General rules
EN 10245 - 2	1995 - 01	Steel wire and wire products - Organic coatings on wire -Part 2: PVC coated wire
EN 10245 - 3	1995 - 01	Steel wire and wire products - Organic coatings on wire -Part 3: PE coated wire
EN 10248 - 1	1995 - 06	Hot rolled sheet piling of non alloy steels - Part 1: Technical delivery conditions
EN 10248 - 2	1995 - 06	Hot rolled sheet piling of non alloy steels - Part 2: Tolerances on shape and dimensions
EN 10249 - 1	1995 - 06	Cold formed sheet piling of non alloy steels - Part 1: Technical delivery conditions
EN 10249 - 2	1995 - 06	Cold formed sheet piling of non alloy steels - Part 2: Tolerances on shape and dimensions
EN 10253 - 1	1994 - 01	Butt; welding pipe fittings wrought carbon steel without specific inspection requirements
EN 10254	1995 - 08	Steel closed die forgings - General technical delivery conditions
EN 10255	1996 - 01	Non-alloy steel tubes suitable for welding or threading
EN 10257 - 1	1994 - 11	Zinc or zinc alloy coated low carbon steel wire for armouring cables - Part 1: Land cables
EN 10257 - 2	1994 - 11	Zinc or zinc alloy coated low carbon steel wire for armouring cables - Part 2: Submarine cables
EN 10267	1995 - 08	Ferritic-pearlitic engineering steels for precipitation hardening from hot-working temperatures
EN 10268	1995 - 10	Cold-rolled flat products made of high field strength steels for cold forming - General delivery conditions
EN 10271	1996 - 03	Electrolyticaly zinc-nickel (ZN) coated cold roled steel flat products - Tehnical delvery conditions
EN 10283	1996 - 04	Corrosion resistant steel casting
EN 10284	1996 - 04	Malleable cast iron fittings with commresion ends for plastics piping system
EN 10285	1996 - 12	Steel tubes and fittings for on and offshore pipelines External three layer extruded polyethylene based coating
EN 10286	1996 - 12	Steel tubes and fittings for on and offshore pipelines External three layer extruded polypropylene based coatings
EN 10287	1996 - 12	Steel tubes and fittings for on and offshore pipelines - External fused polyethylene based coatings
EN 10288	1997 - 01	Steel tubes and fittings for on and offshore pipelines External two layer extruded polyethylene based coatings
EN 20049 - 01	1991 - 12	Melleable cast iron threaded pipe fittings; Part 1: fittings with parallel internal and taper external threads in accordance with ISO 7-1
EN 29658	1991 - 12	Steel; determination of aluminium content; flame atomic absorption spectrometric method (ISO 9658 :1990)
EN ISO 945	1994 - 07	Cast iron - Designation of microstructure of graphite (ISO 945 : 1975)
EN ISO 1127	1995 - 10	Stainless steel tubes - Dimensions, tolerances and conventional masses per unit length
EN ISO 3785	1995 - 01	Steel - Designation of test piece axes (ISO 3785 : 1976)
EN ISO 8434 - 1	1995 - 05	Metallic tube connections for fluid power and general use Part 1: 24 ‹ Grad › compression fittings (ISO 8434-1:1994)
EN ISO 10380	1995 - 05	Corrugated flexible metallic hose and hose assemblies (ISO 10380 : 1994)







In the table of standards for mechanical testing of metallic materials
- methods for static and dynamic mechanical testing,
- methods for non-destructive testing of metallic materials
- and methods for chemical analysis of ferrous materials

are presented.

STANDARDS FOR MECHANICAL TESTING OF METALLIC MATERIALS

Standard	Date	Title
EN 10002 - 1	1996	Metallic materials; tensile testing; part 1: method of test
EN 10002-1/AC/1	1996	Metallic materials; tensile testing; part 1: method of test; amendment to EN 10002 - 1
EN 10002 - 2	1996 - 06	Metallic materials; tensile testing Part 2: verification of the force measuring system of the tensile testing machines
EN 10002 - 3	1996 - 06	Metallic materials; Tensile testing Part 3: Calibration of force proving instruments used for the verification of uniaxial testing machines
EN 10002 - 4	1994 - 11	Metallic materials; tensile test; part 4: verification of extensiometers used in uniaxial testing
EN 10002 - 5	1991 - 10	Metallic materials; tensile testing; part 5: method of testing at elevated temperature
EN 10003 - 1	1996	Metallic materials; Brinell hardness test - Part 1: Test method
EN 10003 - 2	1996 - 06	Metallic materials; Brinell hrdness test; -Part 2: Verification of Brinell hardness testing machines
EN 10003 - 3	1996 - 06	Metallic materials; Brinell hrdness test Part 3: Calibration of standardized blocks to be used for Brinell hardness testing machines
EN 10004 - 1	1991 - 02	Metallic materials; hardness test; part 1: Rockwell test (scales A, B, C, D, E, F, G, H, K)
EN 10004 - 2	1991 - 02	Metallic materials; hardness test Part 2: verification of Rockwell hardness testing machines (scales A, B, C, D, E, F, G, H, K)
EN 10004 - 3	1991 - 02	Metallic materials; hardness test Part 3: calibration of standardized blocks to be used for Rockwell hardness testing machines (scales A, B, C, D, E, F, G, H, K)
EN 10045 - 2	1996 - 06	Metallic materials; Charpy impact test; part 2: verification of the testing machine (pendulum impact)
EN 10109 - 1	1996	Metallic materials - Hardness test - Part 1: Rockwell test (scales A, B, C, D, E, F, G, H, K) and Rockwell superficial test (scales 15N, 30N, 45N, 15T, 30T and 45T)
EN 10109 - 2	1996 - 06	Metallic materials - Hardness test - Part 2: Verification of Rockwell hardness testing machines (scales A, B, C, D, E, F, G, H, K, N, T)
EN 10109 - 3	1996 - 06	Metallic materials - Hardness test - Part 3: Calibration of standardized blocks to be used for Rockwell hardness testing machines (scales A, B, C, D, E, F, G, H, K, N, T)
EN 10232	1993 - 10	Metallic materials; tube (in full section); bend test
EN 10233	1993 - 10	Metallic materials; tube flattening test
EN 10234	1993 - 10	Metallic materials; tube drift expanding test
EN 10235	1993 - 10	Metallic materials; tube flanging test
EN 10236	1993 - 10	Metallic materials; tube; ring expanding test
EN 10237	1993 - 10	Metallic materials; tube; ring tensile test
EN 10238	1995 - 12	Automatically blast cleaned and primed steel products
EN 10251	1995 - 07	Magnetic materials - Methods of determination of geometrical characteristics of electrical steel sheet and strip
EN 10252	1995 - 02	Magnetic materials - Methods of measurement of magnetic properties of magnetic steel sheet and strip at medium frequencies
CR 10261	1995 - 01	ECISS Information Circular 11 - Iron and steel - Review of available methods of chemical analysis
ENV 22605 - 1	1991 - 10	Steel products for pressure purposes; derivation and verification of elevated temperature properties; Part 1: yield or proof stress of carbon and low alloy steel products (ISO 2605-1: 1976)
ENV 22605 - 2	1991 - 10	Steel products for pressure purposes; derivation and verification of elevated temperature properties; Part 2: proof stress of austenitic steel products (ISO 2605-2: 1976)
ENV 22605 - 3	1991 - 10	Steel products for pressure purposes; derivation and verification of elevated temperature properties; Part 3: alternative procedure for deriving the elevated temperature yield or proof stress properties when data are limit (ISO 2605-3: 1985)
EN ISO 945	1994 - 07	Cast iron - Designation of microstructure of graphite (ISO 945 : 1975)
EN ISO 10380	1995 - 05	Corrugated flexible metallic hose and hose assemblies (ISO 10380 : 1994)
EN 10228 - 1	1994 - 05	Non-destructive testing of steel forgings - Part 1: Magnetic particule inspection
EN 10228 - 2	1994 - 05	Non-destructive testing of steel forgings - Part 2: Penetrant testing

STANDARDS FOR NON-DESTRUCTIVE TESTING OF METALLIC MATERIALS

Standard	Date	Title
EN 10228 - 3	1994 -12	Non-destructive testing of steel forgings - Part 3: Ultrasonic testing of ferritic or martensitic steel forgings
EN 10228 - 4	1996 -12	Non-destructive testing of steel forgings - Part 4: Ultrasonic testing of austenitic and austenitic-feritic stainlless forgings
EN 10246 - 1	1995 - 09	Non-destructive testing of steel tubes - Part 1: Automatic electromagnetic testing of seamless and welded (except submerged arc welded) ferromagnetic steel tubes for verification of hydraulic leak-tightness
EN 10246 - 2	1995 - 11	Non-destructive testing of steel tubes - Part 2:
EN 10246 - 3	1995 - 10	Non-destructive testing of steel tubes - Part 3: Automatic eddy current testing of seamless and welded (except submerged arc welded) steel tubes for the detection of imperfections
EN 10246 - 5	1995 - 10	Non-destructive testing of steel tubes - Part 5:Automatic full peripheral magnetic transducer/flux leakage testing of seamless and welded (except submerged arc welded) ferromagnetic steel tubes for the detection of longitudinal imperfections
EN 10246 - 6	1995 - 10	Non-destructive testing of steel tubes - Part 6:Automatic full peripheral ultrasonic testing of seamless steel tubes for the detection of transverse imperfections
EN 10246 - 7	1995 - 09	Non-destructive testing of steel tubes - Part 7:Automatic full peripheral ultrasonic testing of seamless and welded (except submerged arc welded) steel tubes for the detection of longitudinal imperfections
EN 10246 - 8	1995 - 10	Non-destructive testing of steel tubes - Part 8:Automatic ultrasonic testing of the weld seam of electric resistance and induction welded steel tubes for the detection of longitudinal imprefections
EN 10246 - 9	1995 - 10	Non-destructive testing of steel tubes - Part 9:Automatic ultrasonic testing of the weld seam of submerged ar welded steel tubes for the detection of longitudinal and/or transverse imperfections
EN 10246 - 10	1995 - 10	Non-destructive testing of steel tubes - Part 10:Radiographic testing of the weld seam of submerged arc-weld steel tubes for the detection of imperfections
EN 10246 - 14	1995 - 10	Non-destructive testing of steel tubes - Part 14:Automatic ultrasonic testing for the detection of laminar imperfections for seamless and welded (except submerged arc-welded) steel tubes
EN 10246 - 15	1995 - 10	Non-destructive testing of steel tubes - Part 15:Automatic ultrasonic testing of strip/plate used in the manufacture of welded steel tubes for the detection of laminar imperfections
EN 10256	1995 - 06	Non-destructive testing of steel tubes - Qualification and competence of levels 1 and 2 non destructive testing personnel
EN 29302	1991 - 02	Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes; electromagnetic testing for verification of hydraulic leak-tightness
EN 29303	1991 - 02	Seamless and welded (except submerged arc-welded) steel tubes for pressure purposes; full peripheral ultrasonic testing for the detection of longitudinal imperfections

STANDARDS FOR CHEMICAL ANALYSIS OF FERROUS MATERIALS

Standard	Date	Title
EN 10036	1996 - 08	Chemical analysis of ferrous materials; determination of total carbon in steels and irons; gravimetric method after combustion in a stream of oxygen
EN 10071	1996 - 08	Chemical analysis of ferrous materials; determination of manganese in steels and irons; electrometric titration method
EN 10136	1989 - 01	Chemical analysis of ferrous materials; determination of nickel in steels and irons; flame atomic absorption spectrometric method
EN 10177	1989 - 01	Chemical analysis of ferrous materials; determination of calcium in steels; flame atomic absorption spectrometric method
EN 10178	1989 - 01	Chemical analysis of ferrous materials; determination of niobium in steels; spectrophotometric method
EN 10179	1989 - 01	Chemical analysis of ferrous materials; determination of nitrogen (trace amounts) in steels; spectrophotometric method
EN 10181	1989 - 01	Chemical analysis of ferrous materials; determination of lead in steels; flame atomic absorption spectrometric method
EN 10184	1989 - 05	Chemical analysis of ferrous materials; determination of phosphorus in steels and irons; spectrophotometric method
EN 10184/AC	1991 - 09	Chemical analysis of ferrous materials; determination of phosphorus in steels and irons; spectrophotometric method; amendment
EN 10188	1989 - 05	Chemical analysis of ferrous materials; determination of chromium in steels and irons; flame atomic absorption spectrometric method

EN 10200	1991 - 12	Chemical analysis of ferrous materials; determination of boron in steel; spectrophotometric method
EN 10201	1988 - 01	Chemical analysis of ferrous materials; determination of silicon in steels and iron; flame atomic absorption spectrometric method
EN 10211	1995 - 10	Chemical analysis of ferrous materials - Determination of titanium in steel and iron - Flame atomic absorption spectrometric method
EN 10212	1995 - 03	Chemical analysis of ferrous materials - Determination of arsenic in steel and iron - Spectrometric method
EN 10265	1995 - 12	Magnetic materials - Specification for steel sheet and strip with specified mechanical properties and magnetic permeability
EN 10276 - 1	1995 - 09	Chemical analysis of ferrous materials - Determination of oxygen in steel and iron - Part 1: Sampling and preparation of steel samples for oxygen determination
EN 24159	1989 - 05	Ferromanganese and ferrosilicomanganese; determination of manganese content; potentiometric method (ISO 4159, 1 st edition 1978.12.15)
EN 24159/AC 1	1989 - 06	Ferromanganese and ferrosilicomanganese; determination of manganese content; potentiometric method; amendment 1 to EN 24159 : 1989 (ISO 4159 : 1978)
EN 24829 - 1	1990 - 03	Steel and cast iron; determination of total silicon content; reduced molybdosilicate spectrophotometric method part 1: silicon content between 0,05 and 1%
EN 24829 - 1/AC	1991 - 09	Steel and cast iron; determination of total silicon content; reduced molybdosilicate spectrophotometric method part 1: silicon content between 0,05 and 1%; amendment (ISO 4829-1 : 1986)
EN 24829 - 2	1990 - 03	Steel and cast iron; determination of total silicon content; reduced molybdosilicate spectrophotometric method part 2: silicon content between 0,01 and 0,05%
EN 24829 - 2/AC	1991 - 09	Steel and cast iron; determination of total silicon content; reduced molybdosilicate spectrophotometric method part 2: silicon content between 0,01 and 0,05%; amendment (ISO 4829-2 : 1986)
EN 24934	1989 - 05	Steel and cast iron; determination of sulfur content; gravimetric method (ISO 4934, 1 st edition 1980.10.01)
EN 24935	1991 - 12	Steel and cast iron; determination of sulfur content; infrared absorption method after combustion in an induction furnace (ISO 4935 : 1989)
EN 24935/AC	1992 - 06	Steel and iron; determination of sulfur content; infrared absorption method after combustion in an induction furnace; amends (ISO 4935 : 1989)
EN 24937	1990 - 03	Steel and iron; determination of chromium content; potentiometric or visual method
EN 24937/AC	1991 - 09	Steel and iron; determination of chromium content; potentiometric or visual method; amendment (ISO 4937 : 1986)
EN 24938	1990 - 03	Steel and iron; determination of nickel content; gravimetric or titrimetric method
EN 24938/AC	1991 - 09	Steel and iron; determination of nickel content; gravimetric or titrimetric method; amendment (ISO 4938 : 1986)
EN 24943	1990 - 03	Chemical analysis of ferrous metal; determination of copper content; flame atomic absorption spectrometric method
EN 24943/AC	1991 - 09	Chemical analysis of ferrous metal; determination of copper content; flame atomic absorption spectrometric method; amendment (ISO 4943 : 1985)
EN 24946	1990 - 03	Determination of copper content in steel and cast iron
EN 24946/AC	1991 - 09	Steel and cast iron; determination of copper content; 2,2` diquinolyl spectrophotometric method; amendment (ISO 4946 : 1984)
EN 24947	1991 - 03	Steel and cast iron; determination of vanadium content; potentiometric titration method (ISO 4947 : 1986)
EN ISO 10280	1995 - 09	Steel and iron - Determination of titanium content - Diantipyrylmethane spectrophotomatric mathod (ISO 10280 : 1991)
EN ISO 10700	1995 - 09	Steel and iron - Determination of manganese content - Flame atomic absorption spectrometric method (ISO 10700 : 1994)
EN 10211	1995 - 03	Chemical analysis of ferrous materials - Determination of titanium in steel and iron - Flame atomic absorption spectrometric method
EN ISO 10806	1995 - 05	Pipework - Non-alloyed and stainless steel fittings for corrugated flexible metallic hoses (ISO 10806 : 1994)
EN ISO 10807	1995 - 05	Pipework - Corrugated flexible metallic hose assemblies for the protection of electrical cables in explosive atmospheres (ISO 10807 : 1994) Warning: withdrawn document

This group of ASTM standard specifications covers various types of steel pipes, tubes and fittings for high-temperature service, ordinary use and special applications such as fire protection use. Specifications for steel tubes list standard requirements for boiler and superheater tubes, general service tubes, steel tubes in refinery service, heat exchanger and condenser tubes, mechanical and structural tubing.

This article contains ASTM standards for various types of steel pipes which specify requirements for high-temperature service, ordinary use and special applications such as fire protection use.

Specifications for steel tubes list standard requirements for:

- Boiler and superheater tubes
- General service tubes
- Still tubes in refinery service
- Heat exchanger and condenser tubes
- Mechanical tubing and
- Structural tubing.

New standards, which cover the general requirements for alloy and stainless steel pipes, and editorial form and style for writing product specifications are also included.

STEEL PIPES

A53	A53/A53M-99b	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
A74	A74-98	Specification for Cast Iron Soil Pipe and Fittings
A106	A106-99e1	Specification for Seamless Carbon Steel Pipe for High-Temperature Service
A126	A126-95e1	Specification for Grey Iron Castings for Valves, Flanges, and Pipe Fittings
A134	A134-96	Specification for Pipe, Steel, Electric-Fusion (Arc)-Welded (Sizes NPS 16 and Over)
A135	A135-97c	Specification for Electric-Resistance-Welded Steel Pipe
A139	A139-96e1	Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)
A182	A182/A182M-99	Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
A252	A252-98	Specification for Welded and Seamless Steel Pipe Piles
A312	A312/A312M-00	Specification for Seamless and Welded Austenitic Stainless Steel Pipes
A333	A333/A333M-99	Specification for Seamless and Welded Steel Pipe for Low-Temperature Service
A335	A335/A335M-99	Specification for Seamless Ferritic Alloy-Steel Pipe for High-Temperature Service
A338	A338-84 (1998)	Specification for Malleable Iron Flanges, Pipe Fittings, and Valve Parts for Railroad, Marine, and Other Heavy Duty Service at Temperatures Up to 650°F (345°C)
A358 Service	A358/A358M-98	Specification for Electric-Fusion-Welded Austenitic Chromium-Nickel Alloy Steel Pipe for High-Temperature
A369	A369/A369M-92	Specification for Carbon and Ferritic Alloy Steel Forged and Bored Pipe for High-Temperature Service
A376	A376/A376M-98	Specification for Seamless Austenitic Steel Pipe for High-Temperature Central-Station Service
A377	A377-99	Index of Specifications for Ductile-Iron Pressure Pipe
A409 A426	A409/A409M-95ae1 A426-92 (1997)	Specification for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High-Temperature Service Specification for Centrifugally Cast Ferritic Alloy Steel Pipe for High-Temperature Service
A451	A451-93 (1997)	Specification for Centrifugally Cast Austenitic Steel Pipe for High-Temperature Service
A523	A523-96	Specification for Plain End Seamless and Electric-Resistance-Welded Steel Pipe for High-Pressure Pipe-Type Cable Circuits
A524	A524-96	Specification for Seamless Carbon Steel Pipe for Atmospheric and Lower Temperatures
A530	A530/A530M-99	Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe
A648	A648-95e1	Specification for Steel Wire, Hard Drawn for Prestressing Concrete Pipe
A674	A674-95	Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
A691	A691-98	Specification for Carbon and Alloy Steel Pipe, Electric-Fusion-Welded for High-Pressure Service at High Temperatures

A694	A694/A694M-00	Specification for Carbon and Alloy Steel Forgings for Pipe Flanges, Fittings, Valves, and Parts for High-Pressure Transmission Service
A716	A716-99	Specification for Ductile Iron Culvert Pipe
A733	A733-99	Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
A742	A742/A742M-98	Specification for Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe
A746	A746-99	Specification for Ductile Iron Gravity Sewer Pipe
A760	A760/A760M-99	Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
A761	A761/A761M-98	Specification for Corrugated Steel Structural Plate, Zinc-Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches
A762	A762/A762M-98	Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
A790	A790/A790M-99	Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Pipe
A796	A796/A796M-99	Practice for Structural Design of Corrugated Steel Pipe, Pipe-Arches, and Arches for Storm and Sanitary Sewers and Other Buried Applications
A798	A798/A798M-97a	Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
A807	A807/A807M-97	Practice for Installing Corrugated Steel Structural Plate Pipe for Sewers and Other Applications
A810	A810-94	Specification for Zinc-Coated (Galvanized) Steel Pipe Winding Mesh
A813	A813/A813M-95e2	Specification for Single- or Double-Welded Austenitic Stainless Steel Pipe
A814	A814/A814M-96 (1998)	Specification for Cold-Worked Welded Austenitic Stainless Steel Pipe
A849 Pipe	A849-99	Specification for Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage
A861	A861-94e1	Specification for High-Silicon Iron Pipe and Fittings
A862	A862/A862M-98	Practice for Application of Asphalt Coatings to Corrugated Steel Sewer and Drainage Pipe
A865	A865-97	Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints
A872	A872-91 (1997)	Specification for Centrifugally Cast Ferritic/Austenitic Stainless Steel Pipe for Corrosive Environments
A885	A885/A885M-96	Specification for Steel Sheet, Zinc and Aramid Fiber Composite Coated for Corrugated Steel Sewer, Culvert, and Underdrain Pipe
A888	A888-98e1	Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
A926	A926-97	Test Method for Comparing the Abrasion Resistance of Coating Materials for Corrugated Metal Pipe
A928	A928/A928M-98	Specification for Ferritic/Austenitic (Duplex) Stainless Steel Pipe Electric Fusion Welded with Addition of Filler Metal
A929	A929/A929M-97	Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
A930	A930-99	Practice for Life-Cycle Cost Analysis of Corrugated Metal Pipe Used for Culverts, Storm Sewers, and Other Buried Conduits
A943	A943/A943M-95e1	Specification for Spray-Formed Seamless Austenitic Stainless Steel Pipes
A949	A949/A949M-95e1	Specification for Spray-Formed Seamless Ferritic/Austenitic Stainless Steel Pipe
A954	A954-96	Specification for Austenitic Chromium-Nickel-Silicon Alloy Steel Seamless and Welded Pipe
A972	A972/A972M-99	Specification for Fusion Bonded Epoxy-Coated Pipe Piles
A978	A978/A978M-97	Specification for Composite Ribbed Steel Pipe, Precoated and Polyethylene Lined for Gravity Flow Sanitary Sewers, Storm Sewers, and Other Special Applications
A984	A984/A984M-00	Specification for Steel Line Pipe, Black, Plain-End, Electric-Resistance-Welded
A998	A998/A998M-98	Practice for Structural Design of Reinforcements for Fittings in Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
A999	A999/A999M-98	Specification for General Requirements for Alloy and Stainless Steel Pipe
A1005	A1005/A1005M-00	Specification for Steel Line Pipe, Black, Plain End, Longitudinal and Helical Seam, Double Submerged-Arc Welded
A1006	A1006/A1006M-00	Specification for Steel Line Pipe, Black, Plain End, Laser Beam Welded

STEEL TUBES - Boiler, Superheater, and Miscellaneous Tubes

A178	A178/A178M-95	Specification for Electric-Resistance-Welded Carbon Steel and Carbon-Manganese Steel Boiler and Superheater Tubes
A179	A179/A179M-90a (1996) e1	Specification for Seamless Cold-Drawn Low-Carbon Steel Heat-Exchanger and Condenser Tubes
A192	A192/A192M-91 (1996) e1	Specification for Seamless Carbon Steel Boiler Tubes for High-Pressure Service
A209	A209/A209M-98	Specification for Seamless Carbon-Molybdenum Alloy-Steel Boiler and Superheater Tubes
A210	A210/A210M-96	Specification for Seamless Medium-Carbon Steel Boiler and Superheater Tubes
A213	A213/A213M-99a	Specification for Seamless Ferritic and Austenitic Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes
A249	A249/A249M-98e1	Specification for Welded Austenitic Steel Boiler, Superheater, Heat-Exchanger, and Condenser Tubes
A250	A250/A250M-95	Specification for Electric-Resistance-Welded Ferritic Alloy-Steel Boiler and Superheater Tubes
A254	A254-97	Specification for Copper-Brazed Steel Tubing
A268	A268/A268M-96	Specification for Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service
A269	A269-98	Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
A270	A270-98ae1	Specification for Seamless and Welded Austenitic Stainless Steel Sanitary Tubing
A334	A334/A334M-99	Specification for Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service
A423	A423/A423M-95	Specification for Seamless and Electric-Welded Low-Alloy Steel Tubes
A450	A450/A450M-96a	Specification for General Requirements for Carbon, Ferritic Alloy, and Austenitic Alloy Steel Tubes
A608	A608-91a (1998)	Specification for Centrifugally Cast Iron-Chromium-Nickel High-Alloy Tubing for Pressure Application at High Temperatures
A618	A618-99	Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
A632	A632-98	Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small-Diameter) for General Service
A688	A688/A688M-98	Specification for Welded Austenitic Stainless Steel Feedwater Heater Tubes
A771	A771/A771M-95	Specification for Seamless Austenitic and Martensitic Stainless Steel Tubing for Liquid Metal-Cooled Reactor Core Components
A778	A778-98	Specification for Welded, Unanneled Austenitic Stainless Steel Tubular Products
A789	A789/A789M-00	Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing for General Service
A803	A803/A803M-98	Specification for Welded Ferritic Stainless Steel Feedwater Heater Tubes
A822	A822-90 (1995) e1	Specification for Seamless Cold-Drawn Carbon Steel Tubing for Hydraulic System Service
A826	A826/A826M-95	Specification for Seamless Austenitic and Martensitic Stainless Steel Duct Tubes for Liquid Metal-Cooled Reactor Core Components
A847	A847-99a	Specification for Cold-Formed Welded and Seamless High Strength, Low Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance
A908	A908-91 (1998)	Specification for Stainless Steel Needle Tubing
A953	A953-96	Specification for Austenitic Chromium-Nickel-Silicon Alloy Steel Seamless and Welded Tubing

Mechanical Tubes

A179	A179/A179M-90a (1996) e1	Specification for Seamless Cold-Drawn Low-Carbon Steel Heat-Exchanger and Condenser Tubes
A213	A213/A213M-99a	Specification for Seamless Ferritic and Austenitic Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes
A214	A214/A214M-96	Specification for Electric-Resistance-Welded Carbon Steel Heat-Exchanger and Condenser Tubes
A249	A249/A249M-98e1	Specification for Welded Austenitic Steel Boiler, Superheater, Heat-Exchanger, and Condenser Tubes
A498	A498-98	Specification for Seamless and Welded Carbon, Ferritic, and Austenitic Alloy Steel Heat-Exchanger Tubes with Integral Fins
A851	A851-96	Specification for High-Frequency Induction Welded, Unannealed, Austenitic Steel Condenser Tubes

Heat-Exchanger and Condenser Tubes

A511	A511-96	Specification for Seamless Stainless Steel Mechanical Tubing
A512	A512-96	Specification for Cold-Drawn Buttweld Carbon Steel Mechanical Tubing
A513	A513-98	Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
A519	A519-96	Specification for Seamless Carbon and Alloy Steel Mechanical Tubing
A554	A554-98e1	Specification for Welded Stainless Steel Mechanical Tubing

Structural Tubes

A500	A500-99	Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A501	A501-99	Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
A847	A847-99a	Specification for Cold-Formed Welded and Seamless High Strength, Low Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance
A618	A618-99	Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing

Welding Fittings

A234	A234/A234M-99	Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
A403	A403/A403M-99a	Specification for Wrought Austenitic Stainless Steel Piping Fittings
A420	A420/A420M-99	Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low-Temperature Service
A758	A758/A758M-98	Specification for Wrought-Carbon Steel Butt-Welding Piping Fittings with Improved Notch Toughness
A774	A774/A774M-98	Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures



This group of ASTM standards covers steel plates, sheets and strips used in various applications, properties of assorted types of stainless and heat resisting steel wires, drawn galvanized wires for mechanical springs, alloy steel coarse round wires and industrial sizing screens.

This group of ASTM standards covers the requirements to be met by:

1. Steel plate, sheet, and strip used in various applications
2. The properties of assorted types of steel wire, e.g., stainless and heat resisting steel wire, drawn galvanized wire for mechanical springs, and alloy steel coarse round wire
3. Industrial sizing screens.

STEEL PLATE, SHEET AND STRIP

A109	A109/A109M-98a	Specification for Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled
A167	A167-99	Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
A176	A176-99	Specification for Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
A240	A240/A240M-00	Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
A262	A262-98	Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
A263	A263-94a (1999)	Specification for Corrosion-Resisting Chromium Steel-Clad Plate, Sheet, and Strip
A264	A264-94a (1999)	Specification for Stainless Chromium-Nickel Steel-Clad Plate, Sheet, and Strip
A265	A265-94a (1999)	Specification for Nickel and Nickel-Base Alloy-Clad Steel Plate
A345	A345-98	Specification for Flat-Rolled Electrical Steels for Magnetic Applications
A366	A366/A366M-97e1	Specification for Commercial Steel (CS) Sheet, Carbon (0.15 Maximum Percent) Cold-Rolled
A370	A370-97a	Test Methods and Definitions for Mechanical Testing of Steel Products
A380	A380-99e1	Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
A414	A414/A414M-00	Specification for Steel, Sheet, Carbon, for Pressure Vessels
A417	A417-93 (1998)	Specification for Steel Wire, Cold-Drawn, for Zig-Zag, Square-Formed, and Sinuous-Type Upholstery Spring Units
A424	A424-00	Specification for Steel, Sheet, for Porcelain Enameling
A480	A480/A480M-99b	Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
A505	A505-00	Specification for Steel, Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, General Requirements for
A506	A506-93 (1998)	Specification for Steel, Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, Regular Quality and Structural Quality
A507	A507-93 (1998)	Specification for Steel, Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, Drawing Quality
A568	A568/A568M-00	Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for
A569 A570	A569/A569M-98 A570/A570M-98	Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
A604	A604-93 (1998)	Test Method for Macroetch Testing of Consumable Electrode Remelted Steel Bars and Billets
A606	A606-98	Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
A607	A607-98	Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Columbium or Vanadium, or Both, Hot-Rolled and Cold-Rolled
A611	A611-97	Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled
A620	A620/A620M-97	Specification for Drawing Steel (DS), Sheet, Carbon, Cold-Rolled
A622	A622/A622M-97	Specification for Drawing Steel (DS), Sheet and Strip, Carbon, Hot-Rolled
A635	A635/A635M-98	Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot-Rolled
A659	A659/A659M-97	Specification for Commercial Steel (CS), Sheet and Strip, Carbon (0.16 Maximum to 0.25 Maximum Percent), Hot-Rolled
A666	A666-00	Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

A682	A682/A682M-98a	Specification for Steel, Strip, High-Carbon, Cold-Rolled, General Requirements For
A684	A684/A684M-86 (1998)	Specification for Steel, Strip, High-Carbon, Cold-Rolled
A693	A693-93 (1999)	Specification for Precipitation-Hardening Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
A700	A700-99	Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment
A702	A702-89 (1994) e1	Specification for Steel Fence Posts and Assemblies, Hot Wrought
A715	A715-98	Specification for Steel Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled, and Steel Sheet, Cold-Rolled, High-Strength, Low-Alloy, with Improved Formability
A749	A749/A749M-97	Specification for Steel, Strip, Carbon and High-Strength, Low-Alloy, Hot-Rolled, General Requirements for
A751	A751-96	Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products
A763	A763-93 (1999) e1	Practices for Detecting Susceptibility to Intergranular Attack in Ferritic Stainless Steels
A793	A793-96	Specification for Rolled Floor Plate, Stainless Steel
A794	A794-97	Specification for Commercial Steel (CS), Sheet, Carbon (0.16% Maximum to 0.25% Maximum), Cold-Rolled
A829	A829/A829M-95	Specification for Alloy Structural Steel Plates

STEEL WIRE

A227	A227/A227M-99	Specification for Steel Wire, Cold-Drawn for Mechanical Springs
A228	A228/A228M-93	Specification for Steel Wire, Music Spring Quality
A229	A229/A229M-99	Specification for Steel Wire, Oil-Tempered for Mechanical Springs
A230	A230/A230M-99	Specification for Steel Wire, Oil-Tempered Carbon Valve Spring Quality
A231	A231/A231M-96	Specification for Chromium-Vanadium Alloy Steel Spring Wire
A232	A232/A232M-99	Specification for Chromium-Vanadium Alloy Steel Valve Spring Quality Wire
A313	A313/A313M-98	Specification for Stainless Steel Spring Wire
A368	A368-95a	Specification for Stainless Steel Wire Strand
A401	A401/A401M-98	Specification for Steel Wire, Chromium-Silicon Alloy
A407	A407-93 (1998)	Specification for Steel Wire, Cold-Drawn, for Coiled-Type Springs
A478	A478-97	Specification for Chromium-Nickel Stainless Steel Weaving and Knitting Wire
A492	A492-95	Specification for Stainless Steel Rope Wire
A493	A493-95	Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging
A510M	A510M-00	Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel [Metric]
A510	A510-00	Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
A555	A555/A555M-97	Specification for General Requirements for Stainless Steel Wire and Wire Rods
A580	A580/A580M-98	Specification for Stainless Steel Wire
A581	A581/A581M-95b	Specification for Free-Machining Stainless Steel Wire and Wire Rods
A679	A679/A679M-00	Specification for Steel Wire, High Tensile Strength, Cold Drawn
A713	A713-93 (1998)	Specification for Steel Wire, High-Carbon Spring, for Heat-Treated Components
A752M	A752M-93 (1998)	Specification for General Requirements for Wire Rods and Coarse Round Wire, Alloy Steel [Metric]
A752	A752-93 (1998)	Specification for General Requirements for Wire Rods and Coarse Round Wire, Alloy Steel
A764	A764-95	Specification for Metallic Coated Carbon Steel Wire, Coated at Size and Drawn to Size for Mechanical Springs
A805	A805-93 (1998)	Specification for Steel, Flat Wire, Carbon, Cold-Rolled

Group of ASTM Standards for Steel Castings and Forgings

This group of ASTM specifications covers standard properties of steel and iron castings and forgings for valves, flanges, fittings, and other pressure containing parts for high-temperature and low-temperature service.

Additionally, in the table below standards for evaluating the microstructure of graphite in iron castings and methods for mechanical testing of cast irons are presented.

STEEL CASTINGS

A27	A27/A27M-95	Specification for Steel Castings, Carbon, for General Application
A47	A47/A47M-99	Specification for Ferritic Malleable Iron Castings
A48M	A48M-94e1	Specification for Gray Iron Castings [Metric]
A48	A48-94ae1	Specification for Gray Iron Castings
A74	A74-98	Specification for Cast Iron Soil Pipe and Fittings
A126	A126-95e1	Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
A128	A128/A128M-93 (1998)	Specification for Steel Castings, Austenitic Manganese
A148	A148/A148M-93b (1998)	Specification for Steel Castings, High Strength, for Structural Purposes
A159	A159-83 (1993)	Specification for Automotive Gray Iron Castings
A216	A216/A216M-93 (1998)	Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High- Temperature Service
A217	A217/A217M-99	Specification for Steel Castings, Martensitic Stainless and Alloy, for Pressure- Containing Parts, Suitable for High-Temperature Service
A247	A247-67 (1998)	Test Method for Evaluating the Microstructure of Graphite in Iron Castings
A278M	A278M-93e1	Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 350°C
A278	A278-93	Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650°F
A297	A297/A297M-97 (1998)	Specification for Steel Castings, Iron-Chromium and Iron-Chromium-Nickel, Heat Resistant, for General Application
A319 A327M	A319-71 (1995) A327M-91 (1997)	Specification for Gray Iron Castings for Elevated Temperatures for Non-Pressure Containing Parts Test Methods for Impact Testing of Cast Irons (Metric)
A327	A327-91 (1997)	Test Methods for Impact Testing of Cast Irons
A351	A351/A351M-94a (1999)	Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts
A352	A352/A352M-93 (1998)	Specification for Steel Castings, Ferritic and Martensitic, for Pressure-Containing Parts, Suitable for Low-Temperature Service
A356	A356/A356M-98e1	Specification for Steel Castings, Carbon, Low Alloy, and Stainless Steel, Heavy-Walled for Steam Turbines
A367	A367-60 (1999)	Test Methods of Chill Testing of Cast Iron
A389	A389/A389M-93 (1998)	Specification for Steel Castings, Alloy, Specially Heat-Treated, for Pressure-Containing Parts, Suitable for High-Temperature Service
A395	A395/A395M-99	Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
A426	A426-92 (1997)	Specification for Centrifugally Cast Ferritic Alloy Steel Pipe for High-Temperature Service
A436	A436-84 (1997) e1	Specification for Austenitic Gray Iron Castings
A438	A438-80 (1997)	Test Method for Transverse Testing of Gray Cast Iron
A439	A439-83 (1999)	Specification for Austenitic Ductile Iron Castings
A447	A447/A447M-93 (1998)	Specification for Steel Castings, Chromium-Nickel-Iron Alloy (25-12 Class), for High-Temperature Service
A451	A451-93 (1997)	Specification for Centrifugally Cast Austenitic Steel Pipe for High-Temperature Service
A476M	A476M-84 (1993)	Specification for Ductile Iron Castings for Paper Mill Dryer Rolls [Metric]
A476	A476-90 (1997)	Specification for Ductile Iron Castings for Paper Mill Dryer Rolls
A487	A487/A487M-93 (1998)	Specification for Steel Castings Suitable for Pressure Service
A488	A488/A488M-99	Practice for Steel Castings, Welding, Qualifications of Procedures and Personnel
A494	A494/A494M-00	Specification for Castings, Nickel and Nickel Alloy
A518	A518/A518M-99	Specification for Corrosion-Resistant High-Silicon Iron Castings
A532	A532/A532M-93a (1999) e1	Specification for Abrasion-Resistant Cast Irons A

536	A536-84 (1999) e1	Specification for Ductile Iron Castings
A560	A560/A560M-93 (1998)	Specification for Castings, Chromium-Nickel Alloy
A571M	A571M-84 (1997)	Specification for Austenitic Ductile Iron Castings for Pressure-Containing Parts Suitable for Low-Temperature Service [Metric]
A571	A571-84 (1997)	Specification for Austenitic Ductile Iron Castings for Pressure-Containing Parts Suitable for Low-Temperature Service
A583	A583-93 (1999)	Specification for Cast Steel Wheels for Railway Service
A597	A597-87 (1999)	Specification for Cast Tool Steel
A602	A602-94 (1998)	Specification for Automotive Malleable Iron Castings
A608	A608-91a (1998)	Specification for Centrifugally Cast Iron-Chromium-Nickel High-Alloy Tubing for Pressure Application at High Temperatures
A609	A609/A609M-91 (1997)	Practice for Castings, Carbon, Low-Alloy, and Martensitic Stainless Steel, Ultrasonic Examination Thereof
A644	A644-98	Terminology Relating to Iron Castings
A667	A667/A667M-87 (1998)	Specification for Centrifugally Cast Dual Metal (Gray and White Cast Iron) Cylinders
A703	A703/A703M-99	Specification for Steel Castings, General Requirements, for Pressure-Containing Parts
A732	A732/A732M-98	Specification for Castings, Investment, Carbon and Low Alloy Steel for General Application, and Cobalt Alloy for High Strength at Elevated Temperatures
A743	A743/A743M-98ae1	Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application
A744	A744/A744M-98a	Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service
A747	A747/A747M-99	Specification for Steel Castings, Stainless, Precipitation Hardening
A748	A748/A748M-87 (1998)	Specification for Statically Cast Chilled White Iron-Gray Iron Dual Metal Rolls for Pressure Vessel Use
A757	A757/A757M-00	Specification for Steel Castings, Ferritic and Martensitic, for Pressure-Containing and Other Applications, for Low-Temperature Service
A781	A781/A781M-99a	Specification for Castings, Steel and Alloy, Common Requirements, for General Industrial Use
A799	A799/A799M-92 (1997)	Practice for Steel Castings, Stainless, Instrument Calibration, for Estimating Ferrite Content
A800	A800/A800M-91 (1997) e1	Practice for Steel Casting, Austenitic Alloy, Estimating Ferrite Content Thereof
A802	A802/A802M-95 (1996)	Practice for Steel Castings, Surface Acceptance Standards, Visual Examination
A823	A823-99	Specification for Statically Cast Permanent Mold Gray Iron Castings
A834	A834-95	Specification for Common Requirements for Iron Castings for General Industrial Use
A842	A842-85 (1997)	Specification for Compacted Graphite Iron Castings
A872	A872-91 (1997)	Specification for Centrifugally Cast Ferritic/Austenitic Stainless Steel Pipe for Corrosive Environments
A874	A874/A874M-98	Specification for Ferritic Ductile Iron Castings Suitable for Low-Temperature Service
A888	A888-98e1	Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
A890	A890/A890M-99	Specification for Castings, Iron-Chromium-Nickel-Molybdenum Corrosion-Resistant, Duplex (Austenitic/Ferritic) for General Application
A897M	A897M-90 (1997)	Specification for Austempered Ductile Iron Castings [Metric]
A897	A897-90 (1997)	Specification for Austempered Ductile Iron Castings
A903	A903/A903M-99	Specification for Steel Castings, Surface Acceptance Standards, Magnetic Particle and Liquid Penetrant Inspection
A915	A915/A915M-93 (1998)	Specification for Steel Castings, Carbon, and Alloy, Chemical Requirements Similar to Standard Wrought Grades
A942	A942-95	Specification for Centrifugally Cast White Iron/Gray Iron Dual Metal Abrasion- Resistant Roll Shells
A957	A957-96	Specification for Investment Castings, Steel and Alloy, Common Requirements, for General Industrial Use
A958	A958-96e1	Specification for Steel Castings, Carbon, and Alloy, with Tensile Requirements, Chemical Requirements Similar to Standard Wrought Grades
A985	A985-98a	Specification for Steel Investment Casting General Requirements, for Pressure-Containing Parts

A993	A993-98	Test Method for Dynamic Tear Testing of Cast Irons to Establish Transition Temperature
A1002	A1002-99	Specification for Castings, Nickel-Aluminum Ordered Alloy

FORGINGS

A105	A105/A105M-98	Specification for Carbon Steel Forgings for Piping Applications
A181	A181/A181M-95b	Specification for Carbon Steel Forgings, for General-Purpose Piping
A182	A182/A182M-99	Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
A266	A266/A266M-99	Specification for Carbon Steel Forgings for Pressure Vessel Components
A275	A275/A275M-98	Test Method for Magnetic Particle Examination of Steel Forgings
A288	A288-91 (1998)	Specification for Carbon and Alloy Steel Forgings for Magnetic Retaining Rings for Turbine Generators
A289	A289/A289M-97	Specification for Alloy Steel Forgings for Nonmagnetic Retaining Rings for Generators
A290	A290-95 (1999)	Specification for Carbon and Alloy Steel Forgings for Rings for Reduction Gears
A291	A291-95 (1999)	Specification for Steel Forgings, Carbon and Alloy, for Pinions, Gears and Shafts for Reduction Gears
A314	A314-97	Specification for Stainless Steel Billets and Bars for Forging
A336	A336/A336M-99	Specification for Alloy Steel Forgings for Pressure and High-Temperature Parts
A350	A350/A350M-99	Specification for Carbon and Low-Alloy Steel Forgings, Requiring Notch Toughness Testing for Piping Components
A369	A369/A369M-92	Specification for Carbon and Ferritic Alloy Steel Forged and Bored Pipe for High-Temperature Service
A372	A372/A372M-99	Specification for Carbon and Alloy Steel Forgings for Thin-Walled Pressure Vessels
A388	A388/A388M-95	Practice for Ultrasonic Examination of Heavy Steel Forgings
A418	A418-99	Test Method for Ultrasonic Examination of Turbine and Generator Steel Rotor Forgings
A456	A456/A456M-99	Specification for Magnetic Particle Examination of Large Crankshaft Forgings
A469	A469-94a (1999)	Specification for Vacuum-Treated Steel Forgings for Generator Rotors
A471	A471-94 (1999)	Specification for Vacuum-Treated Alloy Steel Forgings for Turbine Rotor Disks and Wheels
A472	A472-98	Test Method for Heat Stability of Steam Turbine Shafts and Rotor Forgings
A473	A473-99	Specification for Stainless Steel Forgings
A484	A484/A484M-98	Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings
A493	A493-95	Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging
A503	A503/A503M-99	Specification for Ultrasonic Examination of Large Forged Crankshafts
A508	A508/A508M-95 (1999)	Specification for Quenched and Tempered Vacuum-Treated Carbon and Alloy Steel Forgings for Pressure Vessels
A522	A522/A522M-95b	Specification for Forged or Rolled 8 and 9% Nickel Alloy Steel Flanges, Fittings, Valves, and Parts for Low-Temperature Service
A541	A541/A541M-95 (1999)	Specification for Quenched and Tempered Carbon and Alloy Steel Forgings for Pressure Vessel Components
A565	A565-97	Specification for Martensitic Stainless Steel Bars, Forgings, and Forging Stock for High-Temperature Service
A579	A579-99	Specification for Superstrength Alloy Steel Forgings
A592	A592/A592M-89 (1999)	Specification for High-Strength Quenched and Tempered Low-Alloy Steel Forged Fittings and Parts for Pressure Vessels
A638	A638/A638M-00	Specification for Precipitation Hardening Iron Base Superalloy Bars, Forgings, and Forging Stock for High-Temperature Service
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